SOLUTIA
Applied Chemistry, Creative Solutions

Solutia Inc.
575 Maryville Centre Drive
St. Louis, Missouri 63141

P.O. Box 66760
St. Louis, Missouri 63166-6760
Tel 314-674-1000

January 8, 2001

Mr. Michael McAteer (1 copy)
U. S. EPA - Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

Re: Sauget Sites Area I January 21, 1999 Administrative Order by Consent June 25, 1999 Support Sampling Plan as approved by letter dated September 9, 1999

- **Ecological Risk Assessment Submittal**

Dear Mr. McAteer,

Pursuant to the Sauget Sites Area I January 21, 1999 Administrative Order by Consent and the June 25, 1999 Support Sampling Plan as approved by letter dated September 9, 1999, Solutia hereby submits the **Ecological Risk Assessment**.

The Ecological Risk Assessment is pursuant to Task 4, "Engineering Evaluation / Cost Analysis Report (EE/CA)", "EECA Outline", Paragraph 2.6 "Ecological Risk Assessment" of the EECA/RIFS SOW, and Task 5, "RIFS (Groundwater)", Paragraph 2 "Risk Assessment for Groundwater" of the EECA/RIFS SOW.

The information from this Ecological Risk Assessment will be used in the EE/CA - RI/FS Reports.

Sincerely,

D. M. Light
Manager, Remedial Projects
Solutia Inc.

cc: (w/attachments)

Candy Morin - Illinois Environmental Protection Agency
Kevin de la Bruere - U.S. Fish and Wildlife Service
Mike Henry - Illinois Department of Natural Resources
Tim Gouger (3 copies) - U.S. Army Corps of Engineers

cc: (w/o attachments)

Thomas Martin - U.S. EPA

Menzie-Cura & Associates, Inc.
One Courthouse Lane
Suite 2
Chelmsford, Massachusetts 01824
Telephone (978) 453-4300
Fax (978) 453-7260

MEMORANDUM

Date: January 8, 2001
File: 648D
To: Michael McAteer, USEPA - Region 5
From: Katherine Fogarty
Subject: Sauget Area I Ecological Risk Assessment Report Submittal
Cc: Candy Morin - IEPA; Kevin de la Bruere - USFWS; Mike Henry - IDNR; Tim Gouger (3 copies) - USACOE; Thomas Martin - USEPA - w/o attachments

This memorandum serves as a Letter of Transmittal for:

One copy of the Sauget Sites Area I Ecological Risk Assessment report;

One copy of the cover letter from D.M. Light of Solutia, Inc. to Michael McAteer of USEPA - Region 5 dated January 8, 2001.

REV. 1

ECOLOGICAL RISK ASSESSMENT
FOR
SAUGET AREA I

SAUGET
ST. CLAIR COUNTY, ILLINOIS

January 8, 2001

Prepared for:

Solutia, Inc.
10300 Olive Boulevard
St. Louis, MO 63141

Prepared by:

Menzie-Cura & Associates, Inc.
One Courthouse Lane, Suite Two
Chelmsford, MA 01824

Katherine A. Fogarty
Project Manager

Susan B. Kane Driscoll
Project Reviewer

Principal

REV. 1

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ACRONYMS

AhR	Aryl Hydrocarbon Receptor
AWQC	Ambient Water Quality Criteria
COPC	Compounds of Potential Concern
DAS	Developed Area Soil
DDE	Dichlorodiphenyl dichloroythelene, a breakdown product of DDT
DDT	Dichlorodiphenyl trichloroethane, an insecticide
EMPC	Estimated Maximum Potential Concentration
FFG	Functional Feeding Groups
IEPA	Illinois Environmental Protection Agency
J	Data Qualifier, Indicates Estimated Value
LEL	Lowest Effect Levels
LOAEL	Lowest Observed Adverse Effect Level
M	Data qualifier; indicates estimated maximum potential concentrations for dioxins
MCPA	2-Methyl-4-chlorophenoxyacetic acid, an herbicide
MCPP	2-(2-Methyl-4-chlorophexoxy) proprionic acid, an herbicide
NOAEL	No Observed Adverse Effect Level
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PEC	Probable Effects Concentrations
QAPP/FSP	Quality Assurance Project Plan/Field-Sampling Plan
RPM	Remediation Project Manager
SEL	Severe Effect Levels
SVOC	Semi-volatile Organic Compounds
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEC	Threshold Effect Concentrations
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalency Quotient
TOC	Total Organic Carbon
TRV	Toxicity Reference Value
U	Data Qualifier; indicates not detected above given detection limit
UAS	Undeveloped Area Soil
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

This baseline ecological risk assessment for Sauget Area I in Sauget and Cahokia, Illinois, addresses Dead Creek surface water and sediment and surficial floodplain soils. Figure 1-1 shows the site locus. The risk assessment follows the work plan for the project (Ecological Risk Assessment Work Plan for Sauget Area I, Sauget, St. Clair County, Illinois, Prepared for Solutia, Inc., St. Louis, MO, Menzie-Cura & Associates, Inc., August 12, 1999; Appendix A) and notes where deviations from the work plan exist due to unanticipated differences in site conditions.

With the agreement of the United States Environmental Protection Agency (USEPA) Remediation Project Manager (RPM) Michael McAteer, the ecological risk assessment is restricted to a portion of Dead Creek Segment F and the Borrow Pit Lake. Creek Segments B through the upper portion of F are subject to a Unilateral Administrative Order issued by the USEPA on May 31, 2000 to Monsanto Company and Solutia Inc. (Docket No. V-W-99-C-554) pursuant to section 106(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended, 42 U.S.C. Section 9606(a). The Order requires the following response activities at Sauget Area 1 Creek Segments B and Site M and Creek Segments C, D, E, and F upstream of the Terminal Railroad Association embankment, which are located in Sauget and Cahokia, Illinois (Figure 1-1):

- Preparation of a Time Critical Removal Action Work Plan;
- Implementation of the Removal Action in accordance with the Work Plan to mitigate the threats posed by presence of contamination in Dead Creek sediments and certain adjacent soils and their potential migration via overflow and flood waters from the Site;
- Removal of materials from CS-B (creek sediments, creek bed soils and flood plain soils); CS-C, D, and E (non-native creek sediments only); and Site M (pond sediments and pond bottom soils) in Sauget Area 1, while minimizing adverse impacts to area wetlands and habitat;
- Proper handling, dewatering, treatment and placement of such materials in the on-site Containment Cell;
- A plan for management of Dead Creek storm water during the removal action;
- Sampling and analysis of areas where materials has been removed, for the purpose of defining remaining contamination;

- Placement of membrane liner material over CS-B and in all other excavated areas where, based on post-removal sample results, such liner is determined to be necessary; and

- Design of a containment cell which will provide adequate protection to human health and the environment.

The Order requires Solutia to conduct these removal activities to abate a potential imminent and substantial endangerment to the public health, welfare or the environment that may be presented by the actual or threatened release of hazardous substances at or from the site.

1.1 Regulatory Guidance

The assessment follows current USEPA guidance in:

Ecological Risk Assessment Guidance For Superfund: Process For Designing and Conducting Ecological Risk Assessments (USEPA, 1997); and

Guidelines for Ecological Risk Assessment (EPA/630/R-95/002F, April 1998).

Previously, the USEPA conducted a Preliminary Ecological Assessment of Dead Creek Segment F, which essentially provides the screening analyses required in Steps 1 and 2 of the guidance (USEPA, 1997).

2.0 BACKGROUND

This section provides a description of Dead Creek, the Borrow Pit Lake, and reference areas.

2.1 Dead Creek and the Borrow Pit Lake

Dead Creek begins immediately south of Queeny Avenue in an industrial area of Sauget, Illinois and flows slowly south through residential neighborhoods (Figure 1-1). Along most of its length, the stream is bordered by a dense, narrow band of riparian trees and shrubs. Homeowners have cleared to the creek's edge and have established lawn along several sections. Creek Section B runs from Queeny Avenue south to Judith Lane, Section C from Judith Lane to Cahokia Street, Section D from Cahokia Street to Jerome Street, and Section E from Jerome Street to the intersection of Routes 3 and 157. Section F begins at the intersection with Route 3, crosses the intersection, passes through a culvert at railroad tracks, and continues to the southwest toward the Borrow Pit Lake. As discussed in Section 1.0, this ecological risk assessment addresses Dead Creek Section F from the railroad culvert south and the Borrow Pit Lake. Photographs of this area showing the predominant habitat types are in Appendix B.

West of Route 3, the creek flows south and west through the American Bottoms floodplain. This area contains active and abandoned agricultural land divided by levees and railroad right-of-ways. After Dead Creek flows under the railroad right-of-way, it is joined by a stream draining land from the north. ?

The Borrow Pit Lake is a borrow pond that was excavated during the construction of the local levee system. The United States Geological Survey (USGS) map of the area (Cahokia) indicates that the pond was dug to its current shape sometime after 1954. The pond is the largest non-flowing water body in the area. Its shore is surrounded with mature riparian trees and emergent wetland vegetation. During time of high water, Dead Creek drains the pond through a pump station under a levee and flows into a ditched section of Prairie du Pont Creek. The channel flows northwest to Arsenal Island on the Mississippi River.

During the site reconnaissance and sampling in September, October, and November of 1999, water levels were extremely low in Dead Creek and the Borrow Pit Lake. Many areas of these water bodies were dry with exposed mud. Fish and other aquatic species (e.g., frogs) were concentrated in shallow puddles.

Section 7.2.1 provides additional detailed description of the habitat of Dead Creek and the Borrow Pit Lake.

2.2 Reference Areas

Reference areas for ecological risk assessment were selected during the ecological site reconnaissance and during the main sampling event. Details of the selection are included in the field report (Soil, Ground Water, Surface Water, Sediment, and Air Sampling Field Sampling Report, Sauget Area 1, Remediation Technology Group, Solutia, Inc., St. Louis, MO, O'Brien & Gere Engineers, Inc., September 2000).

The following criteria were applied for the selection of reference areas:

a) physical similarity to Dead Creek or the Borrow Pit Lake
b) location away from direct influence of industrial discharges, including major highways.

The reconnaissance survey was carried out over a three-day period in September 1999. The selection of reference sampling stations was discussed with Mr. Michael Ondrachek of Weston, who served as representative for the USEPA.

Reference area 1 was a section of Old Prairie du Pont Creek near the town of East Carondelet, approximately 3 miles southwest of the end of Dead Creek in the Borrow Pit Lake. This section of Old Prairie du Pont Creek is a broad shallow water body with a mud substrate similar to the Borrow Pit Lake. It is distant from any influence from the site or other industrial areas, but is similar to the Borrow Pit Lake in that it is near agricultural land. Two sampling locations were selected in reference area 1. These are depicted on Figure 1-1; photographs are in Appendix B.

Two bodies of water in Monroe County, collectively referred to as reference area 2, were selected during the main sampling event. These water bodies were approximately 20 miles south of Dead Creek. It was not possible to obtain permission to sample the second reference area selected during the reconnaissance survey. These two water bodies contained one sampling station each. Reference area 2-1 was in Long Slash Creek north of the culvert where Merrimac Road crosses the creek. This section was similar to Dead Creek sectors B through E in that it was shallow and muddy. Reference area 2-2 was a flooded borrow pit north of Fountain Creek and was similar in depth, hydrology, and surrounding land use to the Borrow Pit Lake. These reference areas are shown on Figure 2-1; photographs are in Appendix B.

3.0 PROBLEM FORMULATION

The problem formulation phase of an ecological risk assessment develops the nature of the problem and presents a plan for analyzing data and characterizing risk. The problem formulation section of this assessment defines the assessment and presents a conceptual model that describes key relationships between potential stressors and assessment endpoints. Assessment endpoints are expressions of the environmental value to be protected at a site that are selected by the consensus of the regulators, the regulated community, and state or local concerns. The problem formulation for this risk assessment was presented in the project work plan (Appendix A).

3.1 Conceptual Site Model

The foundation of an ecological risk assessment is the conceptual site model. According to USEPA guidance, the conceptual model addresses:

environmental setting and contaminants known or suspected to exist at the site;

contaminant fate and transport mechanisms;

mechanisms of ecotoxicity and likely categories of potentially affected receptors;

complete exposure pathways.

Figure 3-1 provides a diagram of the Conceptual Site Model. It illustrates transport of compounds from the site media through the potentially affected habitats to important ecological receptors.

3.1.1 Environmental Setting and Contaminants Known or Suspected to Exist at The Site

The environmental setting is the aquatic environment of a shallow stream, broader semi-impounded basin, and floodplain as described in Section 2.1 of this report. The compounds of potential concern (COPCs) are selected in Section 5 of this report and include herbicides, insecticides, PCBs, metals, polynuclear aromatic hydrocarbons (PAHs), and dioxins.

3.1.2 Contaminant Fate and Transport Mechanisms

In an aquatic system such as Dead Creek, various physical, chemical, and biological transport mechanisms can affect the fate of COPCs. The COPCs listed adsorb onto particulate matter to varying degrees. Therefore, the conceptual model addresses mechanisms affecting particle distribution in aquatic systems. These include:

particulate runoff from the watershed,

deposition in areas of sluggishly flowing waters,

erosion in faster moving stream segments, and

resuspension of particulates from the stream bed and over the floodplain.

Chemicals with lower particle affinities may be more subject to dissolution in and transport by surface water. Increasing solubility generally correlates with increasing bioavailability. In particular, metals may be subject to transport in soluble form, depending on their valence states.

The major biological mechanisms affecting fate and transport are:

biological uptake directly from environmental media;

bioaccumulation through ingestion of prey or media; and

biomagnification through the food chain.

Several of the COPCs are subject to one or all of these biological fate and transport mechanisms.

3.1.3 Mechanisms of Ecotoxicity and Likely Categories of Potentially Affected Receptors

The COPCs may affect the survival and reproductive capacity of benthic biota, fish, invertebrates, vascular plants, and wildlife. The categories of likely potentially affected receptors for an aquatic system such as the Dead Creek and the Borrow Pit include:

The benthic macroinvertebrate community;

warm water fish (e.g., largemouth bass);

waterfowl (e.g., mallard) that feed on plants and macroinvertebrates (including shrimp);

piscivorous birds (e.g., great blue heron, bald eagle);

aquatic mammals (e.g., muskrat) that feed on plants and macroinvertebrates (including freshwater clams);

aquatic mammals (e.g., river otter) that feed on fish and macroinvertebrates (including freshwater clams).

Section 3.2 provides more detail on these receptors.

The possibility for exposure of terrestrial plants and wildlife to COPCs in soil or through soil-based food chains was also considered in the evaluation.

3.1.4 Complete Exposure Pathways

The USEPA guidance indicates that the risk assessment must identify complete exposure pathways before a quantitative evaluation of toxicity to allow the assessment to focus on COPCs that can reach ecological receptors. The likely complete exposure pathways in Dead Creek and the Borrow Pit Lake are:

Sediment to benthic invertebrates via direct contact and ingestion;

Sediment and surface water to aquatic plants via uptake;

Surface water to invertebrates and fish though direct contact and ingestion;

Benthic biota (including freshwater shrimp and clams) to higher order predators (e.g., fish) through the food chain;

Fish and macroinvertebrates (clams and shrimp) to piscivorous fish, mammals, or birds via ingestion;

Soil to soil invertebrates along the creek banks or floodplain via direct contact and/or ingestion;

Soil to plants or wildlife along the creek banks or floodplain via uptake through roots or ingestion.

3.2 Identification of Receptors

This subsection of the ecological risk assessment identifies the receptors (receptor species) and provides the rationale for their selection as representative of the species that occur or are likely to occur near the site. This subsection also provides an ecological characterization of each receptor for use in developing the exposure assessment.

The selected receptors represent those types of organisms most likely to encounter the contaminants of concern at the site. They include a reasonable (although not comprehensive) cross-section of the major functional and structural components of the ecosystem under study based on:

Relative abundance and ecological importance within the selected habitats;

Availability and quality of applicable toxicological literature;

Relative sensitivity to the contaminants of concern;

Trophic status;

Relative mobility and local feeding ranges;

Ability to bioaccumulate contaminants of concern.

The selected species represent different feeding guilds. A guild is a group of animals within a habitat that use resources in the same way. Coexisting members of guilds are similar in terms of their habitat requirements, dietary habits, and functional relationships with other species in the habitat. Guilds may be organized into potential receptor groups. The use of the guild approach allows focused integration of many variables related to potential exposure. These variables include characteristics of COPCs (toxicity, bioaccumulation, and mode of action) and characteristics of potential receptors (habitat, range and feeding requirements, and relationships between species). This approach evaluates potential exposures by considering the major feeding guilds found in a habitat. It is assumed that evaluation of the potential effects of COPCs on the representative species will be indicative of the potential effects of COPCs to individual member classes of organisms within each feeding guild.

The selected species represent the ecological community and its sensitivity to the contaminants of concern and were arrived at based, in part, on knowledge of the area and on discussions with the USEPA and other government agencies. The ecological receptors selected for evaluation include: benthic invertebrates, shellfish, local fin fish, great blue heron, mallard, bald eagle, muskrat, and river otter.

Benthic invertebrates

Benthic invertebrates are potential receptor species in Dead Creek and the Borrow Pit Lake because they:

Have the greatest exposure to sediments;

Provide food for bottom-feeding fish species;

Are relatively immobile (sessile) in habit, and therefore their general health and condition reflects local conditions.

Warm Water Fish Species

Warm water resident fish species were selected to reflect local sediment and water quality conditions. The typical warm water fish species such as centrachids (sunfish, bass) and bottom feeding fish such as bullheads are abundant local residents with a limited foraging range. These organisms are potential receptor species representing local fish because they are:

Resident in the Borrow Pit Lake;

Exposed to sediments as well as surface water;

Represent fish and higher order predators feeding on smaller fish and invertebrates.

Fish were abundant in the Borrow Pit Lake, but were not observed in Dead Creek Section F. Therefore, these receptors were evaluated in the Borrow Pit Lake only.

Aquatic Birds

We have selected great blue heron, mallard duck, and bald eagle to represent aquatic birds feeding in Dead Creek and the Borrow Pit Lake for at least a portion of the time.

Great Blue Heron (*Ardea herodias*)

The great blue heron inhabits salt and freshwater environments, typically shallow waters and shores of lakes, flooded gravel pits, marshes and oceans. In marsh environments, the great blue heron is an opportunistic feeder; they prefer fish, but they will also eat amphibians, reptiles, crustaceans, insects, birds, and mammals. The diet varies but may include up to 100% fish. Great blue heron tend to forage near nesting sites (USEPA, 1993).

These organisms are potential receptor species because they:

Consume fish;

Have a foraging range about equal to the downstream area of the Dead Creek sectors;

Are a higher trophic level predator in the creek and Mississippi River.

Great blue heron, therefore, represent piscivorous birds.

Mallard (*Anas platyrhynchos*)

The mallard is the most common freshwater duck of the United States, found on lakes, rivers, ponds, etc. It is a dabbling duck, and feeds (usually in shallow water) by "tipping up" and eating food off the bottom of the water body. Primarily, it consumes aquatic plants and seeds, but it will also eat aquatic insects, other aquatic invertebrates, snails and other molluscs, tadpoles, fishes, and fish eggs. Ducklings and breeding females consume mostly aquatic invertebrates. The mallard's home range is variable, but an approximate range is 500 hectares. It prefers to nest on ground sheltered by dense grass-like vegetation, near the water.

Mallards are a potential receptor species because they:

Consume both aquatic plants and aquatic invertebrates;

Live on or near the water;

Are a lower trophic level duck in the creek and in the Mississippi River.

Mallards, therefore, represent waterfowl.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are generally found in coastal areas, near lakes or rivers. Their preferred breeding sites are in large trees near open water. They are usually found in areas with minimal human activity. Bald eagles are federally-listed endangered species that overwinter in the Mississippi River valley north of Dead Creek and the Borrow Pit Lake. A pair of bald eagles was observed attempting to nest on the southern tip of Arsenal Island in 1993 and 1994. The nest has since blown down and has not been reconstructed (Collins, 2001).

IEPA + USEPA We saw them in late '99

Bald eagles, although primarily carrion feeders, are opportunistic and will eat whatever is plentiful including fish, birds, and mammals. Foraging areas vary according to season and location. The USEPA (1993) reports a foraging length of 2 to 4.5 miles along a river.

These organisms are potential receptor species because they:

Consume fish;

Are a higher trophic level predator;

Are sensitive to contaminants that biomagnify in the food chain.

The bald eagle, therefore, represents predatory birds.

Aquatic Mammals

This assessment assumes that river otter and muskrat represent aquatic mammals in Dead Creek and the Borrow Pit Lake.

River Otter (*Lutra canadensis*)

The river otter can be found in primarily freshwater but also saltwater environments, but seems to prefer flowing-water habitats rather than still water. It has been found in lakes, marshes, streams, and seashores. It consumes largely fish, but is opportunistic and will consume aquatic invertebrates (crabs, crayfish, etc.), aquatic insects, amphibians, birds (e.g. ducks), small or young mammals, and turtles. They may also sift through sediment for food. The otter dens in banks, in hollow logs, or similar burrow-like places. Home range varies depending on habitat and sex, but an approximate measure is 300 hectares.

River otters are a potential receptor species because they:

Consume fish and aquatic invertebrates;

Live in or near the water;

Are a higher trophic level predator in the creek and in the Mississippi River.

River otters, therefore, represent higher trophic level aquatic mammal.

Muskrat (*Ondatra zibethicus*)

The muskrat is a semiaquatic large rodent which lives near freshwater and brackish aquatic environments: marshes, ponds, creeks, lakes, etc. It feeds largely on aquatic plants, but depending on location and time of year may also consume aquatic invertebrates (crayfish, crabs, etc.), small amphibians, turtles, fish, molluscs, and even young birds. The muskrat lives quite close to the water, either on the bank of the water body or in a lodge constructed in the water body. Its home range is small (0.17 hectares on average) and one study found that muskrats remain within 15 meters of their primary dwellings 50 percent of the time.

Muskrats are a potential receptor species because they:

Consume aquatic plants and aquatic invertebrates;

Live on or near the water;

Are a lower trophic level omnivore in the creek and Borrow Pit Lake.

Muskrats, therefore, represent lower trophic level aquatic mammals.

Soil invertebrates

Soil invertebrates are potential receptor species in Dead Creek banks and floodplain because they:

Have the greatest exposure to soil;

Provide food for birds and mammals;

REV. 1

Are relatively immobile (sessile) in habit, and therefore their general health and Condition reflects local conditions.

4.0 SELECTION OF ASSESSMENT ENDPOINTS AND MEASURES OF EFFECTS

4.1 Assessment Endpoints

Assessment endpoints are expressions of the environmental value to be protected at a site. Assessment endpoints are often not directly measurable. Therefore, the assessment employs measures of effects. These are biological or measurable ecological characteristics which reflect the assessment endpoint (USEPA, 1997). Where the assessment endpoint is not directly measurable, the use of a measure of effect may result in some uncertainty in the risk characterization. Ultimately, the selection of assessment endpoints requires the consensus of the regulators, the regulated community, and state or local concerns. The following assessment endpoints were selected for this ecological risk assessment in the work plan (Appendix A):

Sustainability (survival, growth, and reproduction) of warm water fish species typical of those found in similar habitats (incorporates the assessment of benthic macroinvertebrates). (Although this endpoint included crayfish in the work plan, this species was not observed in Dead Creek Section F or the Borrow Pit Lake. The field report (OBG, Inc., 2000) provides the details of these observations).

Survival, growth, and reproduction of local populations of aquatic wildlife represented by mallard duck, great blue heron, muskrat, and river otter (incorporates the assessment of benthic macroinvertebrates including shrimp and clams).

Survival, growth, and reproduction of individuals within the local bald eagle population that may overwinter near the site.

Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Dead Creek.

The assessment will evaluate risk relative to these assessment endpoints in Creek Section F and the Borrow Pit Lake.

4.2 Measures of Effects

The measures of effect direct data collection needs for the baseline ecological risk assessment. They provide the actual measurements for estimating risk. A weight-of-evidence approach (Menzie et al., 1996) weighs each of the measures of effects by considering:

Strength of association between the measure of effects and assessment endpoint;

Data quality; and

Study design and execution.

Strength of association refers to how well a measure of effects represents an assessment endpoint. The greater the strength of association between the measurement and assessment endpoint, the greater the weight given to that measure of effect in the risk analysis.

The weight given a measure of effect also depends on the quality of the data as well as the overall study design and execution. The data developed in the QAPP/FSP and collected as described in the field sampling report (OBG, Inc., 2000) provides information to evaluate each selected measure.

There is considerable uncertainty associated with estimating risks, because ecological systems are complex and exhibit high natural variability. Measures of effect typically have specific strengths and weaknesses related to the factors discussed above. Therefore, it is common practice to use more than one measure of effect to evaluate each assessment endpoint.

The assessment endpoints and associated measures of effect are summarized in Table 4-1. The endpoints and measures of effect were modified slightly from the work plan to better represent species observed at the site.

5.0 EXPOSURE ASSESSMENT

This section describes the data used in this ecological risk assessment and selects COPCs for assessment.

5.1 Data used in Ecological Risk Assessment

The chemical data used in this assessment were collected in 1999 specifically for this project. The data collection followed the Quality Assurance Project Plan/Field-Sampling Plan (QAPP/FSP) for the project (Ecological Risk Assessment Quality Assurance Project Plan Field Sampling Plan for Sauget Area 1, Prepared for Solutia, Inc., St. Louis, MO, Menzie-Cura & Associates, Inc., August 12, 1999). The QAPP included sampling and analysis for dioxin congeners, herbicides, metals, polychlorinated biphenyls (PCBs), organochlorine pesticides, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs). The field work was documented in:

> Soil, Ground Water, Surface Water, Sediment, and Air Sampling Field Sampling Report, Sauget Area 1, Remediation Technology Group, Solutia Inc., St. Louis, MO, O'Brien & Gere Engineers, Inc., September 2000.

The data and data validation were originally presented in:

> Sauget Area 1 Site, Support Sampling Project, Data Validation Report, Solutia Inc., St. Louis, MO, O'Brien & Gere Engineers, Inc., August 2000.

5.1.1 Sampling Locations

The chemical data used in this ecological risk assessment are by medium:

Surface water: Surface water samples were collected from Dead Creek Section F (3 samples), the Borrow Pit Lake (3 samples) , and the reference areas (2 samples from each of two areas). These locations are shown on Figure 5-1 (Dead Creek, the Borrow Pit Lake and reference area 1) and Figure 2-1 (reference area 2).

Sediment: Surficial sediment samples were collected from depths of 0 to 2 inches from Dead Creek Section F (3 samples), the Borrow Pit Lake (3 samples), and the reference areas (2 samples from each of two areas). These locations are shown on Figure 5-2 (Dead Creek, the Borrow Pit Lake and reference area 1) and Figure 2-1 (reference area 2).

Biota – Plants: Two samples of creeping buttercup (*Ranunculus reptans)* were collected from Dead Creek Section F (co-located with sediment sampling locations) and two samples were collected from the reference areas. A photograph of this species is in Appendix B. This species was collected because it was present in most sections of Dead Creek. It was not present in the Borrow Pit Lake.

Biota – Clams: Three composite freshwater clam (*Pyganodon grandis*) samples were collected from the Borrow Pit Lake and three composite samples were collected from the reference areas. Clams were abundant in the Borrow Pit Lake. A photograph of this species is in Appendix B.

Corps Agree?

Biota – Shrimp: The work plan called for the collection of crayfish, but none were observed during the site reconnaissance or during the main sampling event. It is likely that the substrate of Dead Creek and the Borrow Pit Lake is too silty and muddy to support crayfish. Shrimp (*Palaemonetes kadiakensis*), which were abundant in the Borrow Pit Lake, were substituted for crayfish. A photograph of this species is in Appendix B. One composite shrimp sample was collected from the Borrow Pit Lake and two composite samples were collected from the reference areas. Why? Were in upstream area?

Biota – Fish: Fish were abundant in the Borrow Pit Lake but were not present in Dead Creek Section F. Whole bodies were analyzed for use in the ecological risk assessment. The data used in this risk assessment include: three composite largemouth bass samples from the Borrow Pit Lake and two each from each of the two reference areas; three composite brown bullhead samples from the site and three from the reference areas; and three composite forage fish (minnows and shiners) samples from the site and four from the reference areas.

Soil: Surficial floodplain soil samples were collected from depths of 0 to 6 inches from developed (designated "DAS") and undeveloped (designated "UAS") areas. Sample locations are shown on Figure 5-3.

The summary statistics for these data (by medium and site location or reference area) are presented in Appendix C.

5.1.2 Calculation of PCB and dioxin/furan concentrations

Samples were analyzed for PCB homologs, and polychlorinated dioxin and polychlorinated furan congeners. PCBs, dioxins, and furans are complex mixtures of individual congeners that have different volatilities, solubilities, and rates of biodegradation and metabolism as well as different toxicities. This section discusses how these data were handled in this ecological risk assessment.

Total PCBs were calculated by summing the concentration of the detected homologs and one half the detection limit for homologs that were not detected. If a homolog was never detected in any sample in a particular medium or area, it was not included in the total. Only two out of ten homologs, hexachlorobiphenyl and pentachlorobiphenyl, were detected in sediment and most site biota. An additional two homologs, heptachlorobiphenyl and tetrachlorobiphenyl, were detected only in largemouth bass tissue at the site.

Polychlorinated dioxin and polychlorinated furan congeners were evaluated collectively as a dioxin Toxic Equivalency Quotient (TEQ). 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is the most potent of a group of compounds that bind to an intracellular protein called the aryl hydrocarbon receptor (AhR). Other dioxin congeners also bind to this receptor and have been shown to exert toxic responses similar to those exerted by TCDD. The biological activity of these compounds seems to correlate with their binding affinity to this receptor (WHO, 1998). The toxic equivalency quotient (TEQ) approach was developed to represent the fractional toxicity of dioxin congeners relative to TCDD. TEQs are calculated as follows:

$$\text{TEQ} = \Sigma\ (\text{Dioxin-like Congener Concentration})_i \cdot \text{TEF}_i]_n$$

where,

TEF = toxic equivalency factor for congener i, and
n = number of dioxin-like congeners in the mixture of concern.

Toxic equivalency factors (TEFs) for each dioxin-like congener are available for mammals (the same values used for humans), birds, and fish to account for differing wildlife sensitivities (Van den Berg et al., 1998).

TEQs for dioxins were calculated for each medium by multiplying the detected concentration (or half the detection limit) of each by its TEF and adding the products to obtain the dioxin TEQ. If a congener was never detected in a particular medium or area, it was not included in the total. Data designated with an "M" in the data validation to indicate "estimated maximum potential concentration" were also treated as not detected, since the presence of that particular congener in that sample is not certain.

5.1.3 COPC Selection Process

The selection of COPCs for ecological risk assessment was a multi-step process. The first step was comparison of combined surface water and sediment data to published benchmarks and reference or background concentrations. Table 5-1 compares the maximum concentration detected in surface water of Dead Creek Section F and the Borrow Pit Lake to Illinois Surface Water Quality Standards (Illinois, 1999), National Recommended Water Quality Criteria (USEPA, 1999a), Great Lakes Initiative Tier II Water Quality Guidelines (summarized in Suter and Tsao, 1996), and other water quality guidelines assembled by Suter and Tsao

(1996). Precedence was given to these standards and guidelines in the order given. If multiple values were available for a compound, the Illinois value superceded the national value, which superceded the Great Lakes value. Compounds that exceeded the corresponding benchmarks were retained as COPCs. If a benchmark value was not available for a compound, but it was detected at a concentration greater than twice the average concentration of the combined reference data, it was also retained as a COPC.

Table 5-2 compares maximum sediment concentrations for Dead Creek Section F and the Borrow Pit Lake to consensus-based sediment quality guidelines for freshwater developed by MacDonald et al. (2000), Florida sediment quality guidelines (MacDonald, 1994), and Ontario Sediment Quality Guidelines (Persaud et al., 1993). The use of these guidelines for ecological screening was recommended by Scott Cieniawski of USEPA Region 5. If the concentration exceeded any of the benchmark values, the compound was retained as a COPC. If a benchmark value was not available for a compound, but it was detected at a concentration greater than twice the average concentration of the combined reference data, it was also retained as a COPC.

Compounds considered non-toxic (calcium, magnesium, sodium, and potassium) were not included as COPCs. In addition, two compounds were excluded as COPCs because they were detected at a very low overall frequency (ethylbenzene was detected in one sediment sample out of six at 11 ug/kg and in no other medium; 2,4-dimethylphenol was detected in one of two plant samples at 51 ug/kg and in no other medium).

As a final screen for COPCs presented on Table 5-3, maximum concentrations in site biota were compared to maximum concentrations from the same biota from the reference areas. Additional compounds were retained as COPCs that were detected in site biota at concentrations above those detected in biota from the reference areas, but that had not been detected in surface water and sediment.

The resulting COPCs for ecological risk assessment in Dead Creek are: 2,4-D, dicamba, dichloroprop, MCPA, MCPP, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, silver, zinc, total PCBs, total DDT, aldrin, alpha-chlordane, delta-BHC, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin aldehyde, endrin ketone, gamma chlordane, gamma-BHC, heptachlor, heptachlor epoxide, methoxychlor, acenaphthalene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, dibenzo(a,h)anthracene, diethylphthalate, fluoranthene, indeno(1,2,3-c,d)pyrene, and dioxin calculated as the toxicity equivalent of 2,3,7,8-TCDD. Note that total concentrations of DDT and PAHs were calculated as the sum of the concentrations of individual compounds detected in that sample using one half the detection limit for compounds not detected in that sample but detected in that medium and at that location.

6.0 ECOLOGICAL EFFECTS ASSESSMENT

The effects assessment summarizes and weighs available evidence regarding the potential for contaminants to cause adverse effects. These adverse effects may include impacts on growth, reproduction, and survival. The general approaches used to assess ecological effects are summarized below. Additional details are provided in the risk characterization section.

6.1 General Approach for Assessment of Ecological Effects

Various approaches are used to assess risk to ecological receptors. These individual lines of evidence are evaluated to provide an overall weight of evidence regarding risk. For benthic invertebrates and fish, these include:

- Comparison of concentrations of COPCs in sediment and surface water to established benchmarks;
- Evaluation of sediment toxicity data within the site and with comparison to reference areas;
- Analysis of benthic community structure and comparison to reference locations;
- Examination of concentrations of COPCs in sediment in comparison to reference locations; and
- Comparison of concentrations of COPCs in tissue to toxicity reference values (TRVs) that have been reported to cause adverse effects in similar organisms.

For wildlife (birds and mammals), the approach is:

- Comparison of estimated dietary doses to TRVs that have been reported to cause adverse effects in similar organisms. The assessment also uses observations of wildlife and habitat that have been made during several site visits to Dead Creek and the Borrow Pit Lake.

7.0 RISK CHARACTERIZATION

This section describes the measures of effect for each assessment endpoint, the data collected as part of those measures, and analyses performed with those measures to evaluate each assessment endpoint

7.1 Assessment Endpoint 1; Sustainability of Warm Water Fish

The COPCs may exert direct effects on warm water fish through exposure in the water, sediment, or prey, and indirectly by affecting their prey, the macroinvertebrate community. The associated measures of effects assess exposure pathways and potential effects. Some rely upon direct observations of conditions; some involve measures of toxicity; and others use literature values.

7.1.1 Measure of effect 1a: body burdens of COPCs in selected fish species

Purpose and Rationale. Fish exposed to bioaccumulative compounds in their diet or in water can accumulate these COPCs in their tissues. Contaminants tend to accumulate in organs such as the liver and kidney to a greater degree than in the musculature. However, COPC levels in tissue on a whole body basis are useful for evaluating risks to animals that eat fish. The assessment uses measurements of COPCs in fish tissue to evaluate exposure and effects on the fish, and to provide data for use in other parts of the assessment.

Approach. The assessment uses this endpoint to evaluate exposure and effects. As a measure of exposure, it compares body burdens of COPCs in small forage fish, medium-sized bottom-feeding fish (brown bullheads) and larger piscivorous fish (largemouth bass) to the same fish species in reference areas. Therefore, the comparisons of fish body burdens are used to assess if fish in the Borrow Pit Lake are exposed to COPCs in excess of those that occur in the reference areas. The assessment will also use the body burden data in subsequent sections as input to the food chain exposure models for the representative piscivores (the great blue heron, bald eagle, and river otter).

As a measure of effects, the assessment compares measured body burdens to literature values at which effects have been reported.

Evaluation: Tables 7-1, 7-2 and 7-3 compare concentrations detected in largemouth bass, brown bullhead, and forage fish (small minnows), respectively, from the Borrow Pit Lake to concentrations in reference areas. Compounds detected at higher concentrations in Borrow Pit Lake fish than in fish from reference areas included: dicamba, MCPA, chromium, total PCBs, DDE, alpha chlordane, heptachlor, and 2,3,7,8-TCDD TEQs in largemouth bass; dichloroprop, mercury, total PCBs, DDE, alpha chlordane, heptachlor, and 2,3,7,8-TCDD

TEQs in brown bullhead; and dicamba, MCPA, copper, mercury, DDE, indeno(1,2,3-c,d)pyrene, and dibenz(a,h)anthracene in forage fish (minnows).

Table 7-4 presents NOAEL and LOAEL concentrations in fish tissue from the literature. Where the information is available, NOAEL and LOAEL concentrations have been selected for effects on mortality, growth, and reproduction or development. Tables 7-1, 7-2, and 7-3 also compare these values to concentrations detected in site fish.

The only COPC for which a NOAEL or LOAEL body burden is exceeded in site fish is mercury. The maximum mercury concentration (0.26 mg/kg wet weight) but not the average mercury concentration in brown bullheads slightly exceeded the benchmark of 0.25 mg/kg mercury wet weight. This was due to one composite brown bullhead sample. The other two brown bullhead samples had lower mercury concentrations (0.05 and 0.075 mg/kg wet weight), similar to brown bullheads in the reference areas. The maximum mercury concentration in forage fish samples (0.6 mg/kg wet weight) also exceeded the benchmark, but the average concentration did not. This was also due to the concentration in one composite sample. The concentrations in the two other samples were 0.052 mg/kg wet weight and not detected at a detection limit of 0.1 mg/kg wet weight. These concentrations were similar to those from the reference areas. Largemouth bass concentrations did not exceed any of the available benchmarks. Note that body burden benchmarks were not available for all COPCs detected in fish.

The benchmark value of 0.25 mg/kg wet weight represents a no observed effects concentration for mortality, but a lowest observed effects concentration for reproductive effects (Friedmann et al., 1996). In a feeding study with walleye, a predatory fish, using low and high doses of methylmercury, Friedmann et al. (1996) found that ingestion of methylmercury in prey resulted in an inhibition of growth, testicular development, and immune function. The resulting body burdens from both the low and high methylmercury level diet were associated with these effects. The body burden associated with the low dietary level was 0.25 mg/kg mercury wet weight. Walleye with body burdens at this level exhibited the effects described above, but not mortality. Friedmann et al. point out that a concentration of 0.25 mg/kg mercury wet weight is within the range of mercury concentrations typically detected in North American fish. They gave a range of 0.03 to 0.7 mg/kg mercury (wet weight) in the Northeastern United States and Canada.

The USEPA (1999b) nationwide database on total mercury concentrations in fish tissue contains information on mercury concentrations in fish tissue in Illinois. Most of the samples collected in Illinois are composites of 2 to 5 fish fillets of several species collected in various lakes and rivers in the upper Mississippi River basin from 1990 to 1993. A total of 85 samples were collected in these lakes and rivers. For the fish species in water bodies in the upper Mississippi River basin in Illinois, the concentration of total mercury in composite fillets ranged from less than 0.010 mg/kg (wet weight) to 0.730 mg/kg (wet weight). The minimum concentration (<0.010 mg/kg) was in a composite of 5 channel catfish (*Ictalurus* *punctatus*) collected from the upper Mississippi River in East Grand Tower, Jackson County. The maximum concentration (0.730 mg/kg) was in a composite of 5 largemouth bass (*Micropterus salmoides*) collected from Cedar Lake near Makanda, Jackson County. It should be noted that there is an active mercury fish advisory for largemouth bass in Cedar Lake. Seventy-one largemouth bass samples are listed in the database. Most of these are composite samples, however there are seven individual fish samples. The total mercury concentrations in fillets ranged from 0.010 mg/kg (in a composite of 4 fish collected from the Mississippi River in Rock Island County) to 0.730 mg/kg (in a composite of 5 fish from Cedar Lake). In the individual largemouth bass samples, the mercury concentrations ranged from 0.250 mg/kg to 0.460 mg/kg (both ends of the range measured in Chicago). / Agree

Therefore, the benchmark concentration of 25 mg/kg mercury wet weight is within the range of concentrations detected in fish in the Mississippi River basin in Illinois. The mercury concentrations in Borrow Pit Lake fish that exceed the benchmark concentration may reflect regional conditions and may not necessarily be related to the site, but not detected in Ref / Hg is higher at site

7.1.2 Measure of effect 1b: COPC concentrations in surface water as compared to applicable water quality criteria for protection of fish and wildlife

Purpose and Rationale. Water concentrations provide a measure of exposure, and water quality criteria indicate levels above which effects may occur. This measure of effect evaluates the potential for water concentrations of COPCs in Dead Creek and the Borrow Pit Lake to cause adverse effects.

Approach: The assessment compares measured concentrations of COPCs in surface water to water quality criteria. Exposure of individual fish and the populations of fish partly depend on the exposure field and the distribution and behavior of the fish. Thus, the area over which water quality criteria are exceeded is an important consideration when evaluating exposure. We evaluate effects with respect to spatial extent and degree to which surface water concentrations exceed water quality criteria.

Evaluation: Tables 7-5 and 7-6 compare surface water concentrations in Creek Section F and the Borrow Pit Lake to Illinois Water Quality Standards, National Recommended Water Quality Criteria (or Ambient Water Quality Criteria (AWQC)), Great Lakes Initiative Tier II values, and other water quality guidelines summarized by Suter and Tsao (1996). For metals, the Illinois standards and AWQC were adjusted for measured water hardness, as noted in the tables.

Ten metals and dioxin congeners were detected in surface water in Creek Section F. The acute criterion was exceeded for barium in each sample, and the chronic criteria were exceeded in one or two samples for manganese and aluminum. Concentrations of barium, aluminum and manganese in Creek Section F were less than those detected in reference areas.

In the Borrow Pit Lake, 11 metals, ten pesticides, and dioxin congeners were detected in surface water. Acute criteria were exceeded for aluminum and barium in one or two samples. Chronic criteria were exceeded for aluminum, barium, iron, and manganese in each sample. Concentrations of barium, aluminum, iron and manganese in Borrow Pit Lake surface water were less than those detected in reference areas.

There were no AWQC or other guidelines available for 2,3,7,8-TCDD based only on toxicity. For three pesticide compounds detected in Borrow Pit Lake surface water (dieldrin, endrin, and heptachlor epoxide), detection limits were greater than standards or criteria in one or two out of three samples.

7.1.3 Measure of effect 1c: Sustainability of benthic macroinvertebrate communities that comprise a prey base

Purpose and Rationale. Benthic macroinvertebrates are an important source of food for many fish species. They experience direct sediment exposures due to their life histories. Exposures that result in reduced abundance, diversity, or biomass of these aquatic macroinvertebrates could indirectly effect fish populations. Further, quantitative studies of benthic macroinvertebrates have a long history of use in water quality studies.

The assessment uses the sediment triad approach as part of a weight-of-evidence analysis to evaluate the sustainability of benthic macroinvertebrate communities in Dead Creek and the Borrow Pit Lake. The sediment triad approach evaluates three elements of a benthic community:

Sediment chemistry measurements;

Field assessment of benthic macroinvertebrates;

Sediment toxicity testing using indicator benthic macroinvertebrates.

7.1.3.1 Sediment Chemical Measurements

Concentrations of COPCs in sediment are compared to sediment benchmarks to evaluate whether adverse biological effects to benthic macroinvertebrates could occur. The sediment guidelines used in this assessment are the consensus-based Threshold Effect Concentrations (TECs) and Probable Effects Concentrations (PECs) developed by MacDonald et al. (2000) and the Ontario (Persaud et al., 1993) Lowest Effect Levels (LEL) and Severe Effects Levels (SEL). Sediment concentrations which exceed these benchmarks do not necessarily indicate that adverse effects to benthic macroinvertebrates have occurred. This risk uses multiple lines of evidence to assess if benthic macroinvertebrates are adversely affected by COPCs.

Tables 7-7 and 7-8 compare sediment concentrations in the Creek Section F and the Borrow Pit Lake to Sediment Quality Guidelines.

* In Creek Section F, Probable Effects Concentrations or Severe Effects Levels were exceeded for six metals, cadmium, copper, lead, mercury, nickel, and zinc. Threshold Effects Concentrations were exceeded for these metals and for arsenic, iron, manganese, total PCBs, seven pesticides, and fluoranthene. The only COPCs with concentrations above these guidelines but less than concentrations detected in reference areas were iron and manganese.

In the Borrow Pit Lake, PEC and SEL guidelines were exceeded by manganese and nickel. These metals and arsenic, cadmium, copper, iron, lead, zinc, DDE, total DDT, gamma-BHC, and heptachlor epoxide exceed the TEC and LEL values. Of these, only iron and manganese concentrations are less than those in the reference areas.

This means biased low ?

In both Borrow Pit Lake and Creek Section F, there is some uncertainty because detection limits for some COPCs were greater than the Sediment Quality Guideline values. These included total PCBs in one sample location in Creek Section F. Other compounds that had detection limits greater than sediment guidelines in one or two out of three sample locations in Creek Section F or Borrow Pit Lake were 4,4,'-DDT, aldrin, dieldrin, endrin, heptachlor, heptachlor epoxide, gamma chlordane, and gamma-BHC (lindane). There were no guidelines available for some of the constituents.

7.1.3.2 Field assessment of benthic macroinvertebrate community

Effects are evaluated by comparing the composition and abundance of benthic macroinvertebrates within Dead Creek and the Borrow Pit Lake at different levels of concentrations of COPCs in sediment. Data from the reference areas support the assessment because these reflect conditions in water bodies unaffected by site COPCs.

Several metrics described by Barbour et al. (1999) were employed to discern the status of the benthic macroinvertebrate community in Creek Sector F, the Borrow Pit Lake, and the reference locations (PDC-1, PDC-2, Ref 2-1, and Ref 2-2). These metrics addressed the richness, evenness, and composition of the benthic community as well as the tolerance of each taxon to perturbation.

Samples for benthic community analysis were co-located with sediment sampling locations for chemical analysis. The results and the data summary table are in Appendix D.

Seven metrics were used to assess the benthic community at each station. The number of organisms, the number of taxa, and the three dominant taxa at each station are presented in Table 7-9. The number of taxa was used as a simple measure of richness. Dominant taxa was used as a simple measure of evenness. Three indices were used to measure diversity in terms of heterogeneity at each station, the Shannon-Weaver Index (H'), relative H', and Simpson's

Index (λ). The results of these indices are in Table 7-10. The relative H' index is a comparison of actual diversity to maximum diversity (H'/H'_{max}), where maximum diversity is defined as equal abundance among all taxa. Simpson's Index expresses the probability that two randomly sampled benthic organisms will belong to the same taxa and is a measure of heterogeneity of the benthic community. The composition (Table 7-11) of the benthic community was measured by assessing the relative abundance of six major taxonomic groups (Chironomids, Oligochaetes, Non-chironomid insects, Molluscs, Crustaceans, and Other). A version of Hilsenhoff's Biotic Index of Organic Stream Pollution (Hilsenhoff, 1987), modified to include all benthic macroinvertebrates (Table 7-12), was employed to measure the degree of benthic community impairment based on the tolerance to perturbation of the benthic macroinvertebrates. Data on tolerance were taken from Barbour et al. (1999). Abundance of functional feeding groups (FFG) was also looked at as an additional measure of community impairment and is summarized in Figure 7-1. Data on functional feeding groups were taken from Barbour et al. (1999).

In terms of the number of taxa, dominant taxa, and taxonomic group abundance (Table 7-9), the benthic community from each of the sampling locations resembles the profundal benthic community of an eutrophic lake. This community composition suggests impairment, as samples were taken from the littoral zones of lentic bodies (Borrow Pit Lake and its associated reference location, Ref 2-2) and the low order stream habitats of Dead Creek Section F and the other reference locations, PDC-1, PDC-2, and Ref 2-1. A typical profundal benthic community consists of a low number of taxa dominated by chironomids, oligochaetes and other organisms which are tolerant to low dissolved oxygen concentrations. Impairment of the benthic community is most likely due to the poor habitat (e.g., silty substrate, low dissolved oxygen, etc.) available in these locations. — why?

As described below, site locations show a slightly less impaired benthic community than reference locations. This may in part be due to the relative isolation of the site from agricultural land and development afforded by dense riparian vegetation. Creek Sector F contains the least impaired benthic community as it contains more diverse habitat: a closed canopy, relatively heterogeneous substrate, and higher water level. Overall, impairment as a result of poor habitat may be associated with low water levels and high water temperatures seen in each location. The organically rich sediments of the sampling locations can exacerbate the effects of low water and high temperatures by decreasing already low dissolved oxygen concentrations in the surface water. Concentrations of total organic carbon (TOC) ranged from 12,000 to 84,000 mg/kg dry weight (Appendix A-2). Secondary causes of impairment due to poor habitat include high homogeneity of substrate, silty and very soft sediment, and little to no aquatic macrophytic growth. These are all evident in Dead Creek and the Borrow Pit Lake.

The indices of diversity (H', H'max, and Shannon's) indicate that some locations (i.e., BP-1 and Creek Sector F-1) have a relatively diverse benthic community (Table 7-10). The low number of taxa and the low number of organisms seen in each location, however, overshadow these results (Table 7-11). The number of organisms in reference location Ref 2-1 is greater than the other stations by an order of magnitude. The other metrics employed, however, indicate that Ref 2-1 is impaired to the same degree as the other stations. The greater number of organisms in Ref 2-1 could be an artifact of proportional sub-sampling, which may have resulted in an over-estimation of the number of organisms present in the entire sample, as only 10% of Ref 2-1 was actually analyzed.

According to the modified Hilsenhoff's Biotic Index (Table 7-12), the degree of impairment at all stations in Creek Sector F, the Borrow Pit Lake, and the reference areas ranges from significantly impaired to severely impaired.

Functional Feeding Groups were summarized to assess impairment as well (Figure 7-1). Generalists, such as gather/collectors and omnivores, are the dominant functional feeding groups in nearly all stations. This is an indication of impairment, as generalists are considered more tolerant than specialists such as scrapers and shredders. The abundance of predators is proportionately high in stations F-2 and BP-1. Most of the predators in F-2 were ceratopogonids (biting midges; Order diptera). The predators of BP-1 were a diverse group consisting mainly of odonates (dragon and damselflies) and two species of the Order hemiptera.

The benthic community was impaired in Dead Creek Sector F, the Borrow Pit Lake, and the reference areas. Due to the poor habitat and low water conditions observed during field sampling, it is likely that impairment was mainly a result of these physical conditions (i.e., low water levels, low dissolved oxygen, and silty substrate).

7.1.3.3 Sediment toxicity testing

The assessment uses laboratory sediment bioassays conducted on sediments from Dead Creek, the Borrow Pit Lake, and the reference areas to evaluate the potential effects of whole sediment on representative benthic macroinvertebrates (amphipods and chironomid larvae). The toxicity of the sediment is compared to that of the standard control sediment used by the laboratory as part of the laboratory's standard operating procedures. In samples where the sediment was found to be acutely toxic, chronic toxicity tests were not performed. The summary of the laboratory testing are in Appendix E.

The results of the amphipod and chironomid bioassays are conflicting. The amphipod bioassays do not suggest toxicity in Dead Creek Section F or Borrow Pit Lake sediments, while the chironomid bioassays do suggest toxicity both on site and in the reference areas. Toxicity bioassays are complex and can contain a high degree of variability in their results. These data suggest that site sediments may be toxic to some organisms, but that reference sediments are also toxic to the same organisms. The agent causing the toxicity is unknown.

Hyalella azteca (Amphipod) Acute Toxicity

Survival of the amphipod in the 10-day acute toxicity bioassay was high at all stations in Creek Sector F, the Borrow Pit Lake, and reference locations, indicating that sediment was not acutely toxic to *H. azteca*. There were no statistically significant differences in survival between samples and laboratory controls. Growth of the amphipod was statistically lower in stations 1 and 3 in the Borrow Pit Lake. The results of the *H. azteca* acute toxicity bioassay are presented in Table 7-13.

H. azteca Chronic Toxicity

The results of the 42-day chronic survival, growth, and reproduction toxicity bioassay are presented in Table 7-14. This is a test that is relatively new and there is less experience with its execution and performance as compared to the acute toxicity tests.

The results of the laboratory controls were unexpectedly low. Therefore, the results of the reference locations were used for comparison instead (PDC-1 and PDC-2 for Creek Sector F; Ref 2-2 for the Borrow Pit Lake). With the exception of one reference station (Ref 2-1), survival, growth, and reproduction were statistically similar to the reference stations, indicating that sediments were not chronically toxic to *H. azteca*. conflicts here

Chironomus tentans (Chironomid) Acute Toxicity

Survival of the chironomid larvae in the 10-day acute toxicity bioassay was significantly lower than the laboratory controls in all stations in Creek Sector F, the Borrow Pit Lake, and reference locations. Growth was significantly lower than the laboratory controls in stations F-2, and the reference stations PDC-1, and Ref 2-1. Sediment from Creek Sector-F and stations BP-2, PDC-1, and Ref 2-2 were found to be acutely toxic to *C. tentans* larvae. The results of the *C. tentans* acute toxicity bioassay are presented in Table 7-15.

C. tentans Chronic Toxicity

The results of the 20-day chronic survival, growth, emergence, and reproduction toxicity bioassay are presented in Table 7-16. Survival, emergence, and reproduction in stations BP-1 and BP-3 in the Borrow Pit Lake were significantly lower than laboratory controls. Emergence and reproduction in reference station PDC-2 were significantly lower than laboratory controls.

7.2 Assessment Endpoint 2; Survival, growth, and reproduction of local populations of aquatic wildlife as represented by the mallard duck, great blue heron, muskrat, and river otter

The assessment uses five measures of effects to evaluate risks to aquatic wildlife. The assessment will use exposure models to evaluate different routes of exposure including ingestion of water, sediment and food (plants, benthic macroinvertebrates and fish). This subsection describes these measures of effects.

7.2.1 Measure of effect 2a: Wildlife species composition and habitat use

Purpose and Rationale. This measure of effect directly examines the receptors, wildlife, to estimate if they are using Dead Creek and the Borrow Pit Lake. The assessment is a measure of the degree to which local and migratory wildlife use the habitat and the extent to which it supports their needs.

Approach: The assessment compares the composition and habitat use by wildlife to observations of species composition of wildlife and their use of a reference area. This type of survey is qualitative. The strength of the analysis is that it indicates whether Dead Creek can support wildlife species comparable to unaffected reference areas. However, because of the qualitative nature of the observations and the high natural variability that can exist in wildlife populations, direct observations may not reveal effects.

Evaluation: Menzie-Cura & Associates, Inc. made observations of the site in 1996, and made observations of the site and reference areas during the site reconnaissance survey conducted in September 1999 and during sampling in October and November 1999. The information here is also based on research on ecological receptors at the site.

The portion of Dead Creek Section F included in this assessment flows through riparian woods and shrubs and into the Borrow Pit Lake. The Borrow Pit Lake is the largest non-flowing water body in the area. Its shore is surrounded with mature riparian trees and emergent wetland vegetation. Very little submerged or emergent vegetation grows in the pond. Photographs of these areas in October 1999 are in Appendix B. At that time, water levels were extremely low and sediment was exposed in large portions of the Borrow Pit Lake. Ducks, herons, and fish were observed in the lake. Fish species observed in the pond include: white crappie, largemouth bass, bluegill sunfish, brown bullhead, yellow bullhead, walleye, drum, silver carp, and gar. Table 7-17 lists fish and wildlife species observed at and near the site during the site visit in 1996 and field sampling in 1999.

During high water conditions, Dead Creek flows from the Borrow Pit Lake into the ditched section of Prairie du Pont Creek. At the confluence of Dead Creek and Prairie du Pont Creek and above it, the ditch shore is vegetated with grasses, herbs, and small shrubs. The flow in the ditch is northwest to Arsenal Island on the Mississippi River. Arsenal Island contains areas of mature riparian woods and agricultural fields. The shoreline of the lower end of the ditch (referred to on the USGS map as Cahokia Chute) is lined with riparian woods, principally large cottonwoods and willow. Large catfish, wood duck, wading birds, and turtles were observed in the channel. Cahokia Chute forms the eastern border of Arsenal Island. The waterway flows north to south, draining the region northeast of the island. It appears that during times when the Mississippi River is high, the river uses the chute channel to flow around Arsenal Island. Any water from the Dead Creek watershed therefore only flows through the lower half of the Cahokia Chute between the confluence with the ditched Prairie du Pont and the Mississippi River. The remains of a bald eagle nest and congregating wading birds were observed in 1996 at the southern tip of Arsenal Island, where the Chute flows into the Mississippi.

Extensive wetlands occur west of Route 3, particularly in the vicinity of the Borrow Pit Lake. The Creek's wetlands appeared healthy with no evidence of ecological stress (no chlorotic plants, no monospecific stands of vegetation, no areas of dying or dead vegetation, no observed surface water sheens or sediment staining) with the exception of extremely low water levels observed in the Fall of 1999 when portions of Dead Creek and the Borrow Pit Lake dried out completely. The wetlands also appeared to support a diverse aquatic and terrestrial wildlife community, with abundant prey species (i.e., fish, frogs, turtles) and predatory species (i.e., wading birds, waterfowl, raccoons). The wetlands west of Route 3 receive water from both Dead Creek and from drainage areas to the north.

Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened Species

According to the records of the Illinois Department of Natural Resources' Natural Heritage Inventory, the only federally endangered or threatened species in the study area is the federally threatened bald eagle (*Haliaeetus leucocephalus*). In 1993, a pair of eagles unsuccessfully attempted to nest at the southern tip of Arsenal Island, where the ditched portion of Prairie du Pont Creek enters the Mississippi River. The pair apparently was scared off the site based on the unsuccessful nesting attempt. The next year the pair returned to the island, but no monitoring was conducted to determine if they successfully nested. The nest has since blown down and no other nests have been constructed on the island. Bald eagles were not observed during any of the surveys or field work performed at the site.

EPA saw them in 99

Portions of the area suitable for eagle foraging include waterbodies large enough to support large fish such as carp and catfish. The Mississippi River, the channelized section of Prairie du Pont Creek, and the Borrow Pit Lake appear to support large fish and provide enough open water for eagles to fish. No foraging eagles were observed during the site visit, nor have local people that were surveyed in the area seen eagles in the vicinity.

EPA has

Habitat Known to be Used by State Designated Endangered or Threatened Species

The Illinois Natural Heritage Inventory did not have any records of state-listed endangered or threatened species in the study area. However a number of state-listed wading birds were observed throughout the wetlands and waterways. Illinois endangered species observed were little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), and black-crowned night heron (*Nycticorax nycticorax*). Great egret (*Casmerodius albus*), an Illinois threatened species, was also observed. Small numbers (one to ten individuals) of these wading birds were found foraging along sections of Dead Creek, the ditched length of Prairie du Pont Creek, Cahokia Chute, and the Mississippi River. The largest concentrations of foraging herons (approximately ten individuals at a location) were observed at the confluence of Dead Creek and the ditched Prairie du Pont Creek, and where the ditched Prairie du Pont flows into the Mississippi. These areas likely support the best concentrated fishing areas for wildlife along the waterways.

No wading bird colonies were located within the study area. However, the Illinois Natural Heritage Inventory has documented two 1000-2000 nest mixed-species colonies in East St. Louis. The closest of these two colonies is approximately one mile east of Sauget Area I near the Alton & Southern rail yards in Alorton. The second site is over two miles to the north at Audubon Avenue and 26th Street. These two colonies contain the only breeding little blue heron and snowy egret in Illinois. In addition, black-crowned night heron, great egret, cattle egret (*Bubulcus ibis*), great blue heron (*Ardea herodias*), and green-backed heron (*Butorides virescens*) nest in the colonies.

In 1988, because the region is heavily industrialized with numerous Superfund sites, the U.S. Fish & Wildlife Service (USFWS) collected black-crowned night heron and little blue heron eggs from the Alorton colony for contaminant analysis (Young, 1989 - unpublished draft). Sediment samples were also taken in areas of observed wading bird foraging around the East St. Louis region. No testing was done of sediments in the Dead Creek drainage. Polychlorinated biphenyls (PCBs), DDE, and metals were detected at varying levels in the wading bird eggs.

The observed endangered and threatened wading birds forage on a wide range of aquatic organisms, such as fish, frogs, and crayfish, as well as some terrestrial species such as reptiles and insects. The USFWS study found that wading birds forage over a wide area around East St. Louis. The Dead Creek/Prairie du Pont wetlands system composes a relatively small percentage of the available wetland foraging area in the region.

Reference Areas: Reference area 1 was a section of Old Prairie du Pont Creek near the town of East Carondelet, approximately 3 miles southwest of the end of Dead Creek in the Borrow Pit Lake. This section of Old Prairie du Pont Creek is a broad shallow water body with a mud substrate similar to the Borrow Pit Lake. It is distant from any influence from the site or other industrial areas, but is similar to the Borrow Pit Lake in that it is near agricultural land. It has less of a riparian zone than the Borrow Pit Lake. Wading birds were observed in this area. It supports a similar fish community to the Borrow Pit Lake.

Two bodies of water in Monroe County comprise reference area 2, were selected during the main sampling event. These water bodies were approximately 20 miles south of Dead Creek. Reference area 2-1 was in Long Slash Creek north of the culvert where Merrimac Road crosses the creek. This section was similar to Dead Creek sectors B through E in that it was shallow and muddy. Reference area 2-2 was a flooded borrow pit north of Fountain Creek. Reference area 2-2 had a muddy substrate and similar fish community to the Borrow Pit Lake.

Conclusions: During the various field surveys and contact with state and federal agencies, three categories of sensitive environments were identified in the Dead Creek area: Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened Species, Habitat Known to be Used by State Designated Endangered or Threatened Species, and Wetlands. The state-listed endangered and threatened species observed on site (herons and egrets) forage over a wide area, with the Dead Creek watershed forming only a small part of their available feeding territory.

The Dead Creek watershed also appears to support a diverse plant and animal community. While much of the creek flows through residential neighborhoods, sufficient natural riparian vegetation remains to support local aquatic and terrestrial communities. The ecological stresses observed (lack of emergent or submerged vegetation, impaired benthic invertebrate community) are due to poor habitat conditions including low water levels, silty substrate, and low dissolved oxygen concentrations. No other evidence of ecological stress was evident in Dead Creek or the Borrow Pit Lake. Birds and wildlife species are abundant and making use of the habitat.

7.2.2 Measure of effect 2b: Concentrations of COPCs in aquatic and marsh plants

Purpose and Rationale. The assessment compares concentrations of COPCs in creeping buttercup in Dead Creek Section F to that in reference areas. No submerged or emergent aquatic vegetation was present in the Borrow Pit Lake. Therefore, during the site reconnaissance, creeping buttercup was selected as a plant species that could be grazed upon by waterfowl and herbivorous mammals and that was present in most sections of Dead Creek. This species of plant has a fleshy stem, but a tiny root system. Therefore, the entire plant was analyzed for COPCs. If plants take up metals and PAHs from the water or sediments, waterfowl and herbivorous mammals could be exposed to these COPCs in their diet.

Approach: The endpoint is evaluated in multi-pathway exposure models for the mallard and the muskrat that consider concentrations of COPCs in sediment, water, and food. Exposures of waterfowl and herbivorous mammals within Dead Creek Section F are compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas. The

COPC concentrations measured in creeping buttercup will be used to evaluate potential dietary exposures of the mallard and muskrat.

Evaluation: Table 7-18 compares maximum and average concentrations of COPCs detected in creeping buttercup samples from Dead Creek Section F to samples from reference areas. Compounds detected at higher concentrations in plants from Dead Creek Section F or detected there and not in plants from the reference areas include the metals antimony, cadmium, copper, lead, nickel, and zinc, the PAHs acenaphthylene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene, the herbicide dicholoroprop, the pesticide gamma chlordane, and dioxins. Compounds detected at lower concentrations in plants from on site than at the reference areas include the metals aluminum and arsenic, two PAHs, aldrin, and heptachlor. Compounds detected in plants from the reference area but not from the site include the herbicides dicamba and MCPP, and the metal chromium. This indicates that herbivorous wildlife receptors could be exposed to higher doses of some site COPCs via the food chain than they would at reference areas.

Concentrations of COPCs detected in plants from Dead Creek Section F were used in food chain models to evaluate potential risks to mallards and muskrat, as representative species of herbivorous wildlife. The details of the food chain model are discussed in Appendix E. Results are summarized in Table 7-19.

Food chain modeling indicated that the average doses of COPCs that muskrats receive from ingesting plants, sediment, and surface water from Dead Creek Section F do not exceed NOAEL or LOAEL concentrations, with the exception of aluminum which was detected in plants and sediment from Section F at concentrations lower than the reference areas. The hazard indices for aluminum were 50 and 5 compared to the NOAEL and LOAEL using average concentrations and 70 and 7 using maximum concentrations. Surface water concentrations of aluminum did not contribute appreciably to these hazard indices. Because a muskrat's foraging area is smaller than Creek Section F, the model assumed that a muskrat eats vegetation from Dead Creek Section F year round. This indicates that herbivorous mammals are not at risk above a level associated with a reference area.

Food chain modeling for mallards ingesting plants from Dead Creek Section F year round resulted in hazard indices less than 1 for each COPC using average concentrations and a foraging area of 580 hectares (USEPA, 1993; vs 0.3 hectares in Dead Creek Section F). Hazard indices were also less than one using maximum concentrations and assuming the mallard feeds only in Dead Creek Section F. This indicates that waterfowl that ingest plants from Dead Creek Section F are not at risk from COPCs.

7.2.3 Measure of effect 2c: Concentration of COPCs in surface waters

Purpose and Rationale. Many wildlife species will use Dead Creek and associated wetlands as a drinking water source. The presence of COPCs in water could be a source of exposure to these species. This measure of effect examines this potential route of exposure.

Approach: This endpoint is evaluated by two methods. Concentrations of COPCs in surface water are compared to drinking water values for wildlife developed by Sample et al. (1996). In addition, surface water concentrations are used in multi-pathway exposure models for wildlife that develop exposure doses based on concentrations in sediment, water, and food.

Evaluation: Surface water concentrations of COPCs in Dead Creek were compared to drinking water no observed adverse effects levels (NOAEL) and lowest observed adverse effects levels (LOAEL) developed by Sample et al. (1996). Tables 7-20 and 7-21 summarize these comparisons for Dead Creek Section F and the Borrow Pit Lake. For each compound, the lowest NOAEL values for water were used as benchmarks. In Creek Section F and the Borrow Pit Lake, surface water concentrations do not exceed any of the wildlife benchmarks. Note that there is no benchmark available for some constituents.

The results of food chain modeling are in Appendix E. In each of the food chain models, average and maximum surface water concentrations from Dead Creek Section F and the Borrow Pit Lake did not result in a potential risk to wildlife. Surface water concentrations contributed a minor portion to the hazard indices for each COPC.

7.2.4 Measure of effect 2d: Concentration of COPCs in fish

Purpose and Rationale: Some wildlife species such as the great blue heron and river otter eat primarily fish. This measure of effect evaluates this potential route of exposure.

Approach: The COPC levels measured in fish are used in the multi-pathway exposure model for the great blue heron and river otter that incorporate concentrations in sediment, water, and food. Exposures of the great blue heron and river otter within Dead Creek and the Borrow Pit Lake are compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

Evaluation: Tables 7-1, 7-2, and 7-3 compare maximum and average concentrations of COPCs detected in largemouth bass, brown bullhead, and forage fish, respectively, from the Borrow Pit Lake to concentrations in fish from reference areas.

In largemouth bass, dicamba, MCPA, chromium, zinc, DDE, gamma chlordane, heptachlor, di-n-butylphthalate, and dioxin TEQs were at higher concentrations in samples from the

Borrow Pit Lake than from the reference areas. In brown bullheads, dichloroprop, chromium, mercury, DDE, alpha chlordane, heptachlor, bis(2-ethylhexyl)phthalate and dioxin TEQs were at higher concentrations in samples from the Borrow Pit Lake than from reference areas. For forage fish, dicamba, dichloroprop, MCPA, copper, lead, mercury, zinc, DDE, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and dioxin TEQs were higher in samples from the Borrow Pit Lake. This indicates that exposure to some COPCs via fish ingestion will be higher at the Borrow Pit Lake than in other nearby areas.

Concentrations of COPCs detected in fish the Borrow Pit Lake were used in food chain models to evaluate potential risks to great blue herons and river otter, as representative species of piscivorous wildlife. The details of the food chain model are discussed in Appendix E. Results are summarized in Table 7-19.

For the river otter eating a diet of large and small fish (72% "large fish" such as largemouth bass or brown bullhead and 28% forage fish, based on information in USEPA (1993)) from the Borrow Pit Lake, average concentrations of COPCs in fish tissue, sediment, and surface water resulted in hazard indices less than 1. This model used average concentrations of COPCs to represent an otter integrating exposure from different species of fish consumed and different locations within the Borrow Pit Lake. It also assumes that the Borrow Pit Lake comprises approximately 0.01 of a river otter's foraging area (5 hectares of the Borrow Pit Lake/400 hectare foraging area (USEPA, 1993). When maximum concentrations were used and the river otter was assumed to forage only in the Borrow Pit Lake, hazard indices exceeded 1 for aluminum and mercury. Aluminum concentrations in Borrow Pit Lake fish and sediment are less that those in the reference areas. Mercury concentrations in sediment were similar in the Borrow Pit Lake and reference areas. However some fish species (brown bullhead and small minnows) had higher mercury concentrations on site than in the reference areas. This conservative maximum assessment places an upper bound on potential risk, but does not represent risk to piscivorous mammals at the Borrow Pit Lake.

For the great blue heron, the food chain model using average concentrations of COPCs in small (73% forage fish) and large fish (27% "large" fish such as largemouth bass and brown bullhead based on information in USEPA (1993)) and surface water, the hazard index for mercury compared to the NOAEL dose was 4. The hazard index compared to the LOAEL dose was 0.4. The hazard indices for the rest of the COPCs were less than 1. This model also assumed that great blue heron were foraging onsite from early March to late November (Illinois, 2000) and that a heron's foraging area is approximately the size of the Borrow Pit Lake (a foraging area of 0.6 to 8.4 hectares as reported in USEPA (1993) compared to 4.9 hectares of the Borrow Pit Lake). When a larger foraging area was used (3-mile radius that is likely to be more representatative of herons known to nest in the area (East St. Louis and Alorton, Illinois), hazard indices were less than 1. When maximum concentrations were used in the model and the herons were assumed to forage on site year round, only mercury had a hazard index greater than one. These hazard indices greater than one for mercury are due to concentrations in brown bullhead and small minnows that are higher than in fish from the reference areas. This indicates some potential risk to piscivorous birds due to mercury in fish tissue at the Borrow Pit Lake. The potential risk may be due to regional conditions, as concentrations of mercury in Borrow Pit Lake fish were within the range of concentrations detected in Illinois fish (although higher than site reference areas).

7.2.5 Measure of effect 2e: Concentration of COPCs in benthic macroinvertebrates

Purpose and Rationale. Waterfowl (such as the mallard) and mammals (such as the muskrat and river otter) eat benthic macroinvertebrates as a portion of their diet. This measure of effect evaluates this potential route of exposure.

Approach: The COPC levels measured in benthic macroinvertebrates are used in a multi-pathway exposure model for the mallard, muskrat, and river otter that incorporates concentrations in sediment, water, and food. Exposures of waterfowl and mammals within Dead Creek and the Borrow Pit Lake are compared to 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

Evaluation: Tables 7-22 and 7-23 compare maximum and average concentrations of COPCs detected in shrimp and clams, respectively, from the Borrow Pit Lake to concentrations in shrimp and clams from reference areas. Only one composite shrimp sample was collected from the Borrow Pit Lake. It had higher concentrations of antimony, silver, and dioxin than shrimp samples from the reference areas. The clam samples from Borrow Pit Lake had higher concentrations of MCPP, arsenic, silver, heptachlor, methoxychlor, two phthalates, and dioxin than clam samples from the reference areas.

Concentrations of COPCs detected in shrimp from the Borrow Pit Lake were used in food chain models to evaluate potential risks to mallards; concentrations detected in clams were used to evaluate potential risks to muskrat and river otter. The details of the food chain model are discussed in Appendix E. Results are summarized in Table 7-19.

Food chain modeling indicated that the average doses of COPCs that muskrats receive from ingesting clams, sediment, and surface water from the Borrow Pit Lake do not exceed NOAEL or LOAEL concentrations, with the exception of aluminum which was detected in clams and sediment from the Borrow Pit Lake at concentrations lower than the reference areas. The hazard indices for aluminum were 40 and 4 compared to the NOAEL and LOAEL using average concentrations and 50 and 5 using maximum concentrations. Surface water concentrations of aluminum did not contribute appreciably to these hazard indices.

For the river otter eating clams from the Borrow Pit Lake, average concentrations of COPCs in clam tissue, sediment, and surface water resulted in hazard indices less than 1. This model used average concentrations of COPCs to represent an otter integrating exposure different locations within the Borrow Pit Lake. It also assumes that the Borrow Pit Lake comprises approximately 0.01 of a river otter's foraging area. When maximum concentrations were used and the river otter was assumed to forage only in the Borrow Pit Lake, the hazard index exceeded 1 for aluminum. Aluminum concentrations in Borrow Pit Lake fish and sediment are less that those in the reference areas.

Food chain modeling for mallards ingesting shrimp from Dead Creek Section F resulted in hazard indices less than 1 for each COPC using both average and maximum concentrations.

The results of the food chain modeling indicate that wildlife that consume macroinvertebrates (clams and shrimp) from the Borrow Pit Lake do not experience risk greater that which could occur at a reference area.

7.3 Assessment Endpoint 3: Survival, growth, and reproduction of individuals within the local bald eagle population that may overwinter near the site

The assessment uses an exposure model to evaluate different routes of exposure including ingestion of water, sediment and fish.

7.3.1 Measure of effect 3a: Concentration of COPCs in fish for use in evaluating exposure via the food chain

Purpose and Rationale. Bald eagle may use fish in Dead Creek and associated wetlands as food. The presence of COPCs in fish could be a source of exposure to this species. This measure of effect examines this potential route of exposure.

Approach: This endpoint is evaluated via an exposure model for the bald eagle. The assessment compare exposures to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

Evaluation: Tables 7-2 and 7-3 compare maximum and average concentrations of COPCs detected in largemouth bass and brown bullhead, respectively, from the Borrow Pit Lake to concentrations in fish from reference areas.

As stated in Section 7.2.4, concentrations of some COPCs in largemouth bass and brown bullhead samples from the Borrow Pit Lake were higher than in fish samples from reference areas. In largemouth bass, dicamba, MCPA, chromium, zinc, DDE, gamma chlordane, heptachlor, di-n-butylphthalate, and dioxin TEQs were at higher concentrations in the Borrow Pit Lake than in the reference areas. In brown bullheads, dichloroprop, chromium, mercury, DDE, alpha chlordane, heptachlor, bis(2-ethylhexyl)phthalate and dioxin TEQs were at higher concentrations in the Borrow Pit Lake than in reference areas.

Concentrations of COPCs detected in fish the Borrow Pit Lake were used in food chain models to evaluate potential risks to the bald eagle. The details of the food chain model are discussed in Appendix E. Results are summarized in Table 7-19.

The food chain model for the bald eagle using average concentrations in large fish and surface water did not result in hazard indices for any COPC greater than 1. This model assumed that eagles overwinter in the vicinity of the site from October through March and that the Borrow Pit Lake comprises about 0.003 of the eagles foraging area (5 hectares vs. 1880 hectares foraging area; USEPA, 1993). Using maximum concentrations in large fish and surface water and assuming that the eagle forages year round and only at the Borrow Pit Lake resulted in a hazard index for mercury of 5 compared to the NOAEL dose. However, even for this conservative case, the estimated exposure dose is still less than the LOAEL value. The maximum mercury concentration in largemouth bass and brown bullhead combined was measured in one composite brown bullhead sample that was approximately 5 times higher than mercury concentrations from other large fish from the Borrow Pit Lake. The other samples of largemouth bass and brown bullhead had concentrations similar to the reference area.

7.4 Assessment Endpoint 4: Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Dead Creek

7.4.1 Measure of effect 4a: COPC concentrations in soil samples from the creek bank and floodplain as compared to applicable soil screening levels for protection of wildlife, plants, and soil dwelling invertebrates

Purpose and Rationale. Soil concentrations provide a measure of exposure, and screening level criteria indicate levels above which effects may occur. This measure of effect evaluates the potential for soil concentrations of COPCs in Dead Creek banks and floodplains to cause adverse effects.

Approach: The assessment compares measured concentrations of total contaminant concentrations in soils to existing benchmarks as summarized in Efroymson et al. (1997).

These soil benchmarks are developed from values that represent a LOAEL for plants, soil invertebrates, and wildlife (birds and mammals). Efroymson et al. (1997) selected the lowest of the available values as a soil benchmark.

Discussion: Table 7-24 compares concentrations detected in Dead Creek floodplain surface soils in both developed and undeveloped areas to soil screening benchmarks and a background concentration. The floodplain soil concentrations are represented by either the maximum concentration detected in surface soil (from a depth of 0 to 6 inches) or the 95% upper confidence limit (UCL) on the mean. There were many more surface soil samples than sediment or surface water samples, and therefore a 95% UCL could be calculated for surface soil. The background soil concentrations are represented as twice the average background soil concentration. The background data set comes from three soil samples. As shown on Table 7-24, soil constituents fall into several categories including:

1) constituents for which the maximum site concentrations exceed the benchmark (indicated in yellow on Table 7-24);
2) constituents for which the lower of the site maximum or 95% UCL on the mean exceeds background (or the constituent was not detected in background soil) and no benchmark is available (indicated in green on Table 7-24);
3) constituents for which the maximum site concentration is less than the benchmark;
4) constituents for which the lower of the site maximum or 95% UCL on the mean is within background and there is no benchmark;
5) constituents detected at a frequency of less than 5%; and constituents of low toxicity.

The first category represents constituents that are present in soil in at least one location at concentrations greater than a published ecological toxicity benchmark. Constituents in this category are 2,3,7,8-TCDD TEQs, total PCBs, arsenic, barium, cadmium, copper, lead, molybdenum, nickel, selenium, thallium, vanadium, and zinc. Table 7-25 identifies individual soil sample locations that exceed the benchmark. Soil sample locations are shown on Figure 5-3. Note that many of the identified locations have concentrations slightly above the benchmark and within background. Constituents that exceed both background and the benchmark include: 2,3,7,8-TCDD TEQs (1 location out of 29 surface soil sampling locations); arsenic (1 location out of 65 surface soil sampling locations); barium (1 location out of 65 surface soil sampling locations); copper (2 locations out of 65); lead (2 locations out of 65); molybdenum (2 locations out of 65); nickel (1 location out of 65); selenium (16 locations out of 65); thallium (4 locations out of 65); vanadium (1 location out of 65); and zinc (3 locations out of 65). Detection limits for selenium in the remaining 49 samples were above the benchmark of 0.21 mg/kg.

Selenium was not detected in background soil. The Illinois Environmental Protection Agency (IEPA, 1994) reports a background range of less than 0.12 mg/kg to 2.6 mg/kg selenium in soils within metropolitan statistical areas. The average reported background concentration in these areas is 0.58 mg/kg. Therefore, the selenium concentrations detected in site surface soil are likely to be within the range of background, although selenium was not detected in the three site-specific background samples.

Few soil concentrations exceed both soil benchmarks and background. These sample locations are scattered throughout the Dead Creek floodplain and do not represent a spatial or geographical pattern. The uncertainty in this screening is due to the lack of soil benchmarks for many compounds and, in the case of selenium, detection limits greater than benchmarks.

The second category represents constituents that are present in floodplain soils at concentrations above background, but for which little toxicity information is available. Many constituents fall into this second category (including herbicides, pesticides, SVOCs (mainly PAHs), and VOCs), because soil benchmarks are available for only a few of the compounds detected in soil.

The third, fourth, and fifth categories represent constituents that are unlikely to present an ecological risk because the maximum concentration is less than a conservative benchmark, concentrations are consistent with background, low frequency of detection (less than 5%), or low toxicity (calcium, magnesium, and potassium).

8.0 WEIGHT OF EVIDENCE DISCUSSION OF ECOLOGICAL RISK

The assessment endpoints used in this evaluation are:

> Sustainability (survival, growth, and reproduction) of warm water fish species typical of those found in similar habitats (incorporates the assessment of benthic macroinvertebrates);
>
> Survival, growth, and reproduction of local populations of aquatic wildlife represented by mallard duck, great blue heron, muskrat, and river otter (incorporates the assessment of benthic macroinvertebrates including shrimp and clams);
>
> Survival, growth, and reproduction of individuals within the local bald eagle population that may overwinter near the site; and
>
> Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Dead Creek.

This section weighs the results of each measure of exposure or effect and draws conclusions with regard to each assessment endpoint. Table 8-1 demonstrates this weight of evidence evaluation.

8.1 Sustainability (survival, growth, and reproduction) of warm water fish species typical of those found in similar habitats (incorporates the assessment of benthic macroinvertebrates)

Several COPCs including herbicides, metals, PCBs, pesticides, phthalates, PAHs, and dioxins were detected in fish from the Borrow Pit Lake at concentrations higher than those detected in fish from reference areas indicating that fish at the site have a higher exposure. Of the COPCs detected in fish tissue, only mercury was detected at concentrations exceeding a toxicity benchmark. Mercury concentrations exceeded a toxicity benchmark in one out of three brown bullhead samples and one out of three small forage fish (minnow) samples, but not in largemouth bass. This indicates that there is some potential for adverse effects on fish due to mercury at the site. Mercury was also present in site sediment at concentrations above those detected in reference areas.

The only COPCs in surface water that exceeded available criteria or guidelines were aluminum, barium, iron, and manganese. Concentrations of these metals were lower than in reference area water bodies. Therefore, concentrations of COPCs in surface water do not pose a risk to fish in the Borrow Pit Lake at levels above those that exist in reference areas.

Results of the evaluation of the benthic community indicated that benthic invertebrates are likely affected by poor habitat conditions in Dead Creek and the Borrow Pit Lake. Although concentrations of some COPCs were elevated above sediment concentrations in reference water bodies and above sediment guidelines for the protection of benthic invertebrates, the benthic community was similarly impaired at both the site and the reference areas. Results of toxicity testing were inconclusive and indicated toxicity in site sediment and reference area sediment. The prey base for fish is impaired in the Borrow Pit Lake (and Dead Creek Section F) but only to a similar degree as is present in reference areas. Therefore, site-related chemicals are not considered to pose a risk to the prey base as compared to other areas.

Some species of fish in the Borrow Pit Lake may be at risk due to body burdens of mercury elevated over a toxicity benchmark. However, fish in many regions of the United States and Canada, in general, and Mississippi River basin in Illinois, in particular, have mercury concentrations in the same range and are not near known sources of mercury contamination. In general, fish at the site are at risk due to poor habitat conditions that are no different from conditions in other water bodies in the region. These poor habitat conditions include fluctuating water levels and a reduced prey base due to silty, muddy substrate. Potential risks due to site-related chemicals to fish within the Borrow Pit Lake appear to be negligible to small and are unlikely to influence the sustainability of these populations.

8.2 Survival, growth, and reproduction of local populations of aquatic wildlife represented by mallard duck, great blue heron, muskrat, and river otter (incorporates the assessment of benthic macroinvertebrates including shrimp and clams)

Wildlife species presence and use of the habitat appears to be similar to other water bodies in the region.

Plants in Dead Creek Section F have higher concentrations of some COPCs (metals, PAHs, one herbicide, and two pesticides) than plants from the reference areas. This indicates that plants and wildlife that eat plants (mallards and muskrats) may be exposed to these COPCs to a higher degree at the site. Food chain modeling indicated that these higher exposures do not result in risk to mallards or muskrats.

Concentrations of COPCs in surface water do not pose a risk to wildlife.

Some COPCs are present at higher concentrations in fish from the Borrow Pit Lake than in fish from reference water bodies. These COPCs include herbicides, metals, PCBs, pesticides, phthalates, PAHs, and dioxins. Food chain modeling indicated that these higher exposures do not result in risks to river otter that eat fish. It did indicate potential risks above a NOAEL dose (but below a LOAEL dose) to great blue heron that eat fish from the Borrow Pit Lake.

This potential risk is due to mercury levels in some fish species, if herons forage mainly in the Borrow Pit Lake. If herons forage over a wider area (which is likely since the nesting areas are at least one mile away), no risk due to mercury is estimated (or the risk due to mercury is at a background level).

Concentrations of some COPCs are higher in shrimp and clams from the Borrow Pit Lake than from reference water bodies. This indicates a higher degree of exposure of these organisms and wildlife that eat them. Food chain modeling indicated that these increased exposures do not result in risks to mallards, muskrats, or river otter.

Wildlife appear to use Dead Creek and the Borrow Pit Lake to the same degree as other water bodies in the region. The only potential risk due to COPCs at the site is to piscivorous birds due to mercury in fish. This potential for risk is considered to be low because the mercury dose in fish exceeds a no effects level, but not a level associated with effects on birds. In addition, it is similar to levels measured in fish in many regions of the U.S. and Canada and throughout the Mississippi River basin in Illinois.

8.3 Survival, growth, and reproduction of individuals within the local bald eagle population that may overwinter near the site

Food chain modeling did not predict risks to bald eagles that may eat fish from the Borrow Pit Lake.

8.4 Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Dead Creek

The measure of effect used to evaluate this assessment endpoint was a screening of floodplain surface soil concentrations against ecological benchmarks and background soil concentrations. This screening indicated that some COPCs exceeded ecological benchmarks and background. However, only a few locations had COPC concentrations that exceeded both the ecological benchmark and background. These locations were scattered over the floodplain and did not exhibit a spatial pattern. Therefore, although a conservative screening analysis indicated that there may be some risks to terrestrial wildlife in the floodplain of Dead Creek, the scattered nature of the background exceedances does not indicate wide spread risks.

9.0 DISCUSSION OF UNCERTAINTIES AND EXPOSURE ASSUMPTIONS

To insure that uncertainties in the assessment have been identified and appropriately addressed, this section presents potential sources of uncertainty. This section of the report identifies the major sources of uncertainty along with actions that have been taken to manage this uncertainty within the assessment. The three primary categories of uncertainty in this assessment are exposure assessment uncertainty, field observation uncertainty and food chain modeling uncertainty.

9.1 Exposure Assessment Uncertainty

A variety of measurement endpoints are selected to reduce the uncertainty inherent in the evaluation of exposure in complex ecological systems. While it is impossible to evaluate the condition of every species and local population using the site, it is important to select species that may use the site, are representative of larger feeding guilds, and have a high potential for exposure. Laboratory assessment of tissue concentrations in plants, fish and invertebrates are not expected to include a great deal of uncertainty.

9.2 Field Observation Uncertainty

Field observations occurred over a limited amount of time in 1996 and 1999. In 1999, severely low water levels in Dead Creek, the Borrow Pit Lake, and the reference water bodies, effected ecological conditions.

9.3 Food Chain Modeling Uncertainty

There is uncertainty in the estimates of ingestion rates for wildlife. We rely on studies that present conservative estimates of quantity of food, water and soil in each species' diet (USEPA 1993; Beyer et al. 1994). For example, we assume that some species incidentally ingest sediment during feeding

The actual diets of the species analyzed in the food chain models include a larger diversity of food types than represented in the food chain models. The assessment relied on site data (plants, clam, fish, and shrimp) where possible and representative food types (both plant and animal tissue). It cannot capture each unique diet item in the diet of wildlife..

The quantity of sediment that an animal ingests while consuming plants or invertebrates is uncertain. The assumptions used in the food chain models are conservative to minimize the effect of the uncertainty. For certain COPCs, sediment is a significant component of the total dose. In certain cases, and for certain compounds, tissue concentrations represent a significant component of the total dose.

The assessment relies on two sources for wildlife ingestion and exposure information, USEPA (1993) and Beyer et al. (1994). The wildlife soil ingestion rates provided by Beyer et al. (1994) are based on a percentage of the dry mass of food ingested per day. The food ingestion rates and the concentrations in food are provided on a wet weight basis. To apply the Beyer et al (1994) values for soil, we adjust the food ingestion rate to a dry weight basis (assume moisture content of invertebrates=80%, and moisture content of plants=70%) and then apply the Beyer et al. (1994) values to obtain the dry soil ingestion rate in grams per gram body weight per day.

The development of toxicological benchmarks involves uncertainty because they are derived from laboratory studies and must be extrapolated to the field. In many cases, extrapolations are also made between species. This is standard practice in ecological risk assessment and yields benchmarks that are likely to be conservative. Testing is often rigorous, however the tests are generally performed on standard laboratory species and then the results are adjusted for other species based on body weight. While the species assessed are not standard laboratory species, they are species with readily available toxicological benchmarks.

To capture uncertainty in the food chain assessment, this assessment calculated hazard indices using both a No Observed Adverse Effect Level (NOAEL) and the Lowest Observed Adverse Effect Level (LOAEL). In a few cases, a hazard index using the NOAEL exceeds one, while the hazard index using the LOAEL is less than one. The uncertainty is bounded between the two toxicological benchmarks.

10.0 SUMMARY AND CONCLUSIONS

The baseline ecological risk assessment for Sauget Area I in Sauget and Cahokia, Illinois, addresses Dead Creek surface water and sediment and surficial floodplain soils. The assessment follows the work plan for the project. The ecological risk assessment is restricted to a portion of Dead Creek Segment F and the Borrow Pit Lake. Creek Segments B through the upper portion of F are subject to a Unilateral Administrative Order issued by the USEPA on May 31, 2000 to Monsanto Company and Solutia Inc. (Docket No. V-W-99-C-554) to remove sediments from Sauget Area 1 Creek Segments B and Site M and Creek Segments C, D and E, which are located in Sauget and Cahokia, Illinois.

Assessment endpoints and measures of effects were selected in the project work plan. The assessment endpoints are:

> Sustainability (survival, growth, and reproduction) of warm water fish species typical of those found in similar habitats (incorporates the assessment of benthic macroinvertebrates);
>
> Survival, growth, and reproduction of local populations of aquatic wildlife represented by mallard duck, great blue heron, muskrat, and river otter (incorporates the assessment of benthic macroinvertebrates including shrimp and clams);
>
> Survival, growth, and reproduction of individuals within the local bald eagle population that may overwinter near the site; and
>
> Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Dead Creek.

Results indicate that: Should list out all concerns

> Some species of fish in the Borrow Pit Lake may be at risk due to body burdens of mercury elevated over a toxicity benchmark. The concentrations measured in Borrow Pit Lake fish are within the range measured in the Mississippi River Basin in Illinois. In general, fish at the site are at risk due to poor habitat conditions that are no different from conditions in other water bodies in the region. These poor habitat conditions include fluctuating water levels and a reduced prey base due to silty, muddy substrate. Mercury was the only COPC detected in whole fish tissues that presented a potential risk to fish. Surface water did not pose a risk to fish or other aquatic organisms above risks present in other water bodies in the region based on a comparison of concentrations to Illinois standards and federal criteria. The benthic invertebrate prey

base of fish was impaired based on benthic community analysis and toxicity testing, but this impairment was similar to that observed in other water bodies in the region unaffected by industry. The impairment is due in part to silty bottom conditions, fluctuating water levels and possibly due to background levels of agricultural chemicals.

Wildlife appear to use Dead Creek and the Borrow Pit Lake to the same degree as other water bodies in the region. The only potential risk due to COPCs at the site is to piscivorous birds due to consumption of mercury in fish. This potential for risk is considered to be low because the mercury dose in fish exceeds a no effects level, but does not exceed the level associated with adverse effects on birds. This potential risk is not indicated if heron are assumed to forage over a three-mile radius. Food chain modeling indicated that other wildlife that feed at Dead Creek Section F or the Borrow Pit Lake (muskrats, river otter, and mallards) are not at risk due to ingestion of COPCs in food items (plants, clams, fish, and shrimp), sediment, or surface water.

Bald eagles, a federally-listed endangered species, overwinter in the Mississippi River Valley to the north of the site. Bald eagles attempted to nest near the site in 1993 and 1994, but have not been observed near the site recently. Food chain modeling did not False predict risks to bald eagles that may eat fish from the Borrow Pit Lake.

A screening of floodplain surface soil concentrations against ecological benchmarks and background soil concentrations indicated that some COPCs exceeded ecological benchmarks and background. However, only a few locations had COPC concentrations that exceeded both the ecological benchmark and background. These locations were scattered over the floodplain and did not exhibit a spatial pattern. Therefore, although a conservative screening analysis indicated that there may be some risks to terrestrial wildlife in the floodplain of Dead Creek, the scattered nature of the background exceedances does not indicate wide spread risks.

11.0 REFERENCES

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TABLES

TABLE 4-1
ASSESSMENT ENDPOINTS
AND ASSOCIATED MEASURES OF EFFECT
DEAD CREEK AND THE BORROW PIT LAKE
SAUGET AREA I

Assessment Endpoint 1: Sustainability of warm water fish

Measure of effect 1a: body burdens of COPCs in selected fish species as a measure of exposure (compared to body burdens in fish from reference areas) and effects (compared to benchmark values).

Measure of effect 1b: COPC concentrations in surface water as compared to applicable water quality criteria for protection of fish and wildlife.

Measure of effect 1c: sustainability of a benthic macroinvertebrate community that can serve as a prey base for fish:

Concentration of COPCs in sediment;

Field assessment of benthic macroinvertebrate community structure;

Sediment toxicity tests.

Assessment Endpoint 2: Survival, growth, and reproduction of local populations of aquatic wildlife as represented by the, mallard duck, great blue heron, muskrat, and river otter

Measure of effect 2a: Wildlife species composition and habitat use.

Measure of effect 2b: Concentration of COPCs in aquatic/marsh plants for use in evaluating exposure via the food chains for mallard duck and muskrat.

Measure of effect 2c: Concentration of COPCs in surface waters in comparison to wildlife benchmarks.

Measure of effect 2d: Concentration of COPCs in fish for use in evaluating exposure via the food chain for great blue heron and river otter.

Measure of effect 2e: Concentration of COPCs in macroinvertebrates (shrimp and/or clams) for use in evaluating exposure via the food chain for mallard duck, river otter and muskrat.

Assessment Endpoint 3: Survival, growth, and reproduction of individuals within the local bald eagle population that may overwinter near the site

Measure of effect 3a: Concentration of COPCs in fish for use in evaluating exposure via the food chain.

Assessment Endpoint 4: Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Dead Creek

Measure of effect 4a: Soil screening effect levels for the protection of wildlife, plants, and soil dwelling invertebrates.

Table 5-1
Comparison of Maximum Surface Water Concentrations to Standards and Guidelines
Dead Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Site Maximum Detected[1]	Illinois[2] Acute WQ Standards	Illinois[2] Chronic WQ Standards	NAWQ Criteria[3] CMC	NAWQ Criteria[3] CCC	Tier II Values[4] Secondary Acute Value	Tier II Values[4] Secondary Chronic Value	Oak Ridge Lowest Chronic Value for All Organisms[4]	Maximum Detected Reference[1]	Twice Average of Reference Area	Preliminary Screening	Comments
Herbicides (ug/l)												
2,4,5-T										0.5	out	not detected in sw
2,4,5-TP (Silvex)										0.5	out	not detected in sw
2,4-D										0.5	out	not detected in sw
2,4-DB										0.5	out	not detected in sw
Dalapon										120	out	not detected in sw
Dicamba										1.2	out	not detected in sw
Dichloroprop										6	out	not detected in sw
Dinoseb										6	out	not detected in sw
MCPA										120	out	not detected in sw
MCPP										120	out	not detected in sw
Pentachlorophenol at pH 7.4				13	10					1	out	not detected in sw
Metals/Inorganics (mg/l)												
Aluminum	3.4			0.75*	0.087*				19.5	26.45	In	greater than criteria
Antimony						0.18	0.03			0.02	Out	not detected in sw
Arsenic	0.015	0.36	0.19	0.34	0.15	0.066*******	0.0031*******		0.017	0.02915	Out	no exceedance
Barium	0.32					0.11	0.004		0.41	0.7175	In	greater than Tier II
Beryllium						0.035	0.00066		0.00083	0.0027475	Out	not detected in sw
Cadmium		0.024	0.0021	0.011	0.0046					0.005	out	not detected in sw
Calcium	89							116	72	117.25	Out	low toxicity; nutrient
Chromium	0.0041	3.3/0.016	0.39/0.011	3.4** / 0.016***	0.16** / 0.011***				0.0225	0.03075	Out	no exceedance
Cobalt	0.0015					1.5	0.023		0.0076	0.0114	Out	no exceedance
Copper	0.012	0.037	0.023	0.029	0.018				0.0185	0.02455	Out	no exceedance
Cyanide, Total		0.022	0.0052	0.022	0.0052					0.01	Out	not detected in sw
Iron	8.7				1				25.5	32.75	In	greater than criteria; less than ref.
Lead	0.02	0.26	0.055	0.22	0.0087				0.032	0.0515	Out	Less than IL criteria
Magnesium	33							82	35	53.5	Out	low toxicity; nutrient
Manganese	1.7					2.3	0.12		2.9	3.95	In	Greater than criteria
Mercury		0.0026	0.0013	0.0014	0.00077		0.0013			0.0002	Out	not detected in sw
Molybdenum	0.004					16	0.37		0.00655	0.010725	Out	no exceedance
Nickel	0.021			0.91	0.1				0.0245	0.03475	Out	no exceedance
Potassium	7.6							53	11	17	Out	low toxicity; nutrient
Selenium					0.005					0.01	Out	not detected in sw
Silver				0.016			0.00036			0.01	out	not detected in sw
Sodium	24							680	23	38	Out	low toxicity; nutrient
Thallium						0.11	0.012			0.01	out	not detected in sw
Vanadium	0.014					0.28	0.02		0.0525	0.08475	Out	no exceedance
Zinc	0.075			0.23	0.23				0.13	0.15175	Out	no exceedance
Fluoride (mg/l)	0.29								0.38	0.625	Out	no criteria; less than reference
Hardness as CaCO3 (mg/l)	350								330	512.5	Out	water quality parameter
Ortho-Phosphate-P (mg/l)	0.83								0.215	0.2345	Out	water quality parameter
pH	9.7				6.5 - 9				8.1	15.65	out	water quality parameter
Suspended Solids (mg/l)	160								700	840	Out	water quality parameter
Total Dissolved Solids (mg/l)	480								460	735	Out	water quality parameter
Total Phosphorus (mg/l)	1.2								3	3.285	Out	water quality parameter
PCB (ug/l)					0.014******							
Decachlorobiphenyl										0.5	Out	not detected in sw
Dichlorobiphenyl										0.1	Out	not detected in sw
Heptachlorobiphenyl										0.3	Out	not detected in sw
Hexachlorobiphenyl										0.2	Out	not detected in sw
Monochlorobiphenyl										0.1	Out	not detected in sw
Nonachlorobiphenyl										0.5	Out	not detected in sw
Octachlorobiphenyl										0.3	Out	not detected in sw
Pentachlorobiphenyl										0.2	Out	not detected in sw
Tetrachlorobiphenyl										0.2	Out	not detected in sw
Trichlorobiphenyl										0.1	Out	not detected in sw

Table 5-1
Comparison of Maximum Surface Water Concentrations to Standards and Guidelines
Dead Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Site Maximum Detected[1]	Illinois[2] Acute WQ Standards	Illinois[2] Chronic WQ Standards	NAWQ Criteria[3] CMC	NAWQ Criteria[3] CCC	Tier II Values[4] Secondary Acute Value	Tier II Values[4] Secondary Chronic Value	Oak Ridge Lowest Chronic Value for All Organisms[4]	Maximum Detected Reference[1]	Twice Average of Reference Area	Preliminary Screening	Comments
Pesticides (ug/l)												
4,4'-DDD						0.19*********	0.011*********			0.1	Out	not detected in sw
4,4'-DDE									0.0015	0.07575	Out	not detected in sw
4,4'-DDT				1.1	0.001		0.013+		0.0057	0.07785	Out	not detected in sw
Aldrin				3					0.004	0.0282	Out	not detected in sw
Alpha Chlordane				2.4****	0.0043****				0.013	0.03245	Out	not detected in sw
alpha-BHC	0.001					39********	2.2********		0.00155	0.030025	Out	no exceedance
beta-BHC	0.02					39********	2.2********		0.015	0.02325	Out	no exceedance
delta-BHC	0.0022					39********	2.2********		0.007	0.0125	Out	no exceedance
Dieldrin	0.001			0.24	0.056				0.0036	0.05285	Out	no exceedance
Endosulfan I	0.0024			0.22*****	0.056*****		0.51		0.026	0.0202	Out	no exceedance
Endosulfan II				0.22*****	0.056*****		0.51		0.000096	0.075048	Out	not detected in sw
Endosulfan sulfate	0.0032								0.007	0.03195	Out	no criteria; less than reference
Endrin	0.00095			0.086	0.036				0.0054	0.05294	Out	no exceedance
Endrin aldehyde	0.0032								0.05115	0.100575	Out	no critena; less than reference
Endrin ketone	0.0027								0.011	0.05785	Out	no criteria; less than reference
Gamma Chlordane									0.0031	0.02696	Out	not detected in sw
gamma-BHC (Lindane)	0.0038			0.95					0.01155	0.012875	Out	no exceedance
Heptachlor	0.0029			0.52	0.0038	0.125	0.0069		0.0035	0.03925	Out	no exceedance
Heptachlor epoxide	0.00096			0.52	0.0038				0.0082	0.01185	out	no exceedance
Methoxychlor					0.03		0.019			0.5	Out	not detected in sw
Toxaphene				0.73	0.0002					5	Out	not detected in sw
SVOC (ug/l)												
1,2,4-Trichlorobenzene						700	110			10	Out	not detected in sw
1,2-Dichlorobenzene						260	14			10	Out	not detected in sw
1,3-Dichlorobenzene						630	71			10	Out	not detected in sw
1,4-Dichlorobenzene						180	15			10	Out	not detected in sw
2,2'-Oxybis(1-Chloropropane)										10	Out	not detected in sw
2,4,5-Trichlorophenol										10	Out	not detected in sw
2,4,6-Trichlorophenol										2.1	Out	not detected in sw
2,4-Dichlorophenol										10	Out	not detected in sw
2,4-Dinitrophenol										14	Out	not detected in sw
2,4-Dinitrotoluene										10	Out	not detected in sw
2,6-Dinitrotoluene										10	Out	not detected in sw
2-Chloronaphthalene										10	Out	not detected in sw
2-Chlorophenol										10	Out	not detected in sw
2-Methylnaphthalene										10	Out	not detected in sw
2-Methylphenol (o-cresol)						230	13			10	Out	not detected in sw
2-Nitroaniline										50	Out	not detected in sw
2-Nitrophenol										10	Out	not detected in sw
3,3'-Dichlorobenzidine										20	Out	not detected in sw
3-Methylphenol/4-Methylphenol										10	Out	not detected in sw
3-Nitroaniline										50	Out	not detected in sw
4,6-Dinitro-2-methylphenol										13	Out	not detected in sw
4-Bromophenylphenyl ether							1.5			1	Out	not detected in sw
4-Chloro-3-methylphenol										10	Out	not detected in sw
4-Chloroaniline										20	Out	not detected in sw
4-Chlorophenylphenyl ether										10	Out	not detected in sw
4-Nitroaniline										50	Out	not detected in sw
4-Nitrophenol						1200	300			50	Out	not detected in sw
Acenaphthene										10	Out	not detected in sw
Acenaphthylene										10	Out	not detected in sw
Anthracene						13	0.73			10	Out	not detected in sw
Benzo(a)anthracene						0.49	0.027			10	Out	not detected in sw
Benzo(a)pyrene						0.24	0.014			10	Out	not detected in sw
Benzo(b)fluoranthene										10	Out	not detected in sw
Benzo(g,h,i)perylene										10	Out	not detected in sw
Benzo(k)fluoranthene										10	Out	not detected in sw
bis(2-Chloroethoxy)methane										10	Out	not detected in sw

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bis(2-Chloroethyl)ether										10	Out	not detected in sw
bis(2-Ethylhexyl)phthalate						27	3			1.8	Out	not detected in sw
Butylbenzylphthalate							19			10	Out	not detected in sw
Carbazole										10	Out	not detected in sw
Chrysene										10	Out	not detected in sw
Di-n-butylphthalate						190	35			10	Out	not detected in sw
Di-n-octylphthalate								708		10	Out	not detected in sw
Dibenzo(a,h)anthracene										10	Out	not detected in sw
Dibenzofuran						66	3.7			10	Out	not detected in sw
Diethylphthalate						1800	210			10	Out	not detected in sw
Dimethylphthalate										10	Out	not detected in sw
Fluoranthene	0.7							15		10	Out	no exceedance
Fluorene						70	3.9			1	Out	not detected in sw
Hexachlorobenzene										10	Out	not detected in sw
Hexachlorobutadiene										10	Out	not detected in sw
Hexachlorocyclopentadiene										10	Out	not detected in sw
Hexachloroethane						210	12			1.9	Out	not detected in sw
Indeno(1,2,3-cd)pyrene										10	Out	not detected in sw
Isophorone										10	Out	not detected in sw
N-Nitroso-di-n-propylamine										10	Out	not detected in sw
N-Nitrosodiphenylamine						3800	210			5	Out	not detected in sw
Naphthalene						190	12			10	Out	not detected in sw
Nitrobenzene										3.5	Out	not detected in sw
Pentachlorophenol										5	Out	not detected in sw
Phenanthrene	0.7							200		10	Out	no exceedance
Phenol										10	Out	not detected in sw
Pyrene										10	Out	not detected in sw
VOC (ug/l)												
1,1,1-Trichloroethane						200	11			5	Out	not detected in sw
1,1,2,2-Tetrachloroethane						2100	610			5	Out	not detected in sw
1,1,2-Trichloroethane						5200	1200			5	Out	not detected in sw
1,1-Dichloroethane						830	47			5	Out	not detected in sw
1,1-Dichloroethene						450	25			5	Out	not detected in sw
1,2-Dichloroethane						8800	910			5	Out	not detected in sw
1,2-Dichloropropane										5	Out	not detected in sw
2-Butanone (MEK)						240000	14000			25	Out	not detected in sw
2-Hexanone						1800	99			25	Out	not detected in sw
4-Methyl-2-pentanone (MIBK)						2200	170			25	Out	not detected in sw
Acetone	18					28000	1500		38	56.5	Out	no exceedance
Benzene	1.7					2300	130			1.2	Out	less than criteria
Bromodichloromethane										5	Out	not detected in sw
Bromoform										5	Out	not detected in sw
Bromomethane (Methyl bromide)										9.8	Out	not detected in sw
Carbon disulfide						17	0.92			5	Out	not detected in sw
Carbon tetrachloride						180	9.8			5	Out	not detected in sw
Chlorobenzene						1100	64			5	Out	not detected in sw
Chloroethane										10	Out	not detected in sw
Chloroform						490	28			5	Out	not detected in sw
Chloromethane										10	Out	not detected in sw
cis-1,3-Dichloropropene										1	Out	not detected in sw
Cis/Trans-1,2-Dichloroethene										5	Out	not detected in sw
Dibromochloromethane										5	Out	not detected in sw
Ethylbenzene						130	7.3			5	Out	not detected in sw
Methylene chloride (Dichloromethane)						26000	2200			4.7	Out	not detected in sw
Styrene										5	Out	not detected in sw
Tetrachloroethene						830	98			5	Out	not detected in sw
Toluene						120	9.8			5	Out	not detected in sw
trans-1,3-Dichloropropene										5	Out	not detected in sw
Trichloroethene						440	47			2.7	Out	not detected in sw

Table 5-1
Comparison of Maximum Surface Water Concentrations to Standards and Guidelines
Dead Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Site Maximum Detected[1]	Illinois[2] Acute WQ Standards	Illinois[2] Chronic WQ Standards	NAWQ Criteria[3] CMC	NAWQ Criteria[3] CCC	Tier II Values[4] Secondary Acute Value	Tier II Values[4] Secondary Chronic Value	Oak Ridge Lowest Chronic Value for All Organisms[4]	Maximum Detected Reference[1]	Twice Average of Reference Area	Preliminary Screening	Comments
Vinyl chloride										10	Out	not detected in sw
Xylenes, Total						230++ / 32+++	13++ / 1.8+++			5	Out	not detected in sw
Dioxins (ug/l)												
1,2,3,4,6,7,8,9-OCDD	0.00143								0.0074		In	COPC in sediment
1,2,3,4,6,7,8,9-OCDF	0.00026								0.0001955		In	COPC in sediment
1,2,3,4,6,7,8-HpCDD	0.0000692								0.000183		In	COPC in sediment
1,2,3,4,6,7,8-HpCDF	0.0000505								0.0000445		In	COPC in sediment
1,2,3,4,7,8,9-HpCDF	0.000548								0.0000119		In	COPC in sediment
1,2,3,4,7,8-HxCDD									0.000008		In	COPC in sediment
1,2,3,4,7,8-HxCDF	0.000024										In	COPC in sediment
1,2,3,6,7,8-HxCDD									0.0000098		In	COPC in sediment
1,2,3,6,7,8-HxCDF	0.0000089								0.0000072		In	COPC in sediment
1,2,3,7,8,9-HxCDD									0.0000139		In	COPC in sediment
1,2,3,7,8,9-HxCDF									0.0000127		In	COPC in sediment
1,2,3,7,8-PeCDD									0.0000087		In	COPC in sediment
1,2,3,7,8-PeCDF									0.0000071		In	COPC in sediment
2,3,4,6,7,8-HxCDF											In	COPC in sediment
2,3,4,7,8-PeCDF									0.0000059		In	COPC in sediment
2,3,7,8-TCDD											In	COPC in sediment
2,3,7,8-TCDF									0.00000835		In	COPC in sediment
Total HpCDD	0.000128								0.0004035		In	COPC in sediment
Total HpCDF	0.0006								0.0001515		In	COPC in sediment
Total HxCDD	0.0000902								0.00006425		In	COPC in sediment
Total HxCDF	0.000581								0.0000368		In	COPC in sediment
Total PeCDD									0.0000083		In	COPC in sediment
Total PeCDF									0.00001635		In	COPC in sediment
Total TCDD									0.000017		In	COPC in sediment
Total TCDF									0.000009		In	COPC in sediment
Total TEQ (mammal)	1.901E-05						3.1E-09				In	Greater than Great Lakes Tier I

Notes:
Results in ug/l for organic constituents; mg/l for inorganic constituents
*At pH 6.5 - 9.0, see G, I, and L under *National recommended water quality criteria for non priority pollutants*
** Chromium III
*** Chromium VI
****For Chlordane
*****For alpha- and beta-Endosulfan
******For PCBs
*******For Arsenic V
********For BHC (other)
*********For DDD p,p
+For DDT
++For Xylene
+++For m-Xylene
aFor chlordane
Hardness dependent criteria calculated at a hardness of 220 mg/l as $CaCO_3$ (the lowest detected on site)
[1] A blank in this column indicates compound was not detected in surface water in this location
[2] Illinois, 1999. Title 35 of the Illinois Administrative Code, Subtitle C, Chapter I, Part 302 Water Quality Standards, Subpart B.
[3] USEPA, 1999. Natioanl Recommended Water Quality Criteria - Correction, Office of Water, EPA 82-2-Z-99-001 (April 1999)
[4] Suter, G.W. II, and C.L. Tsao, 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effect on Aquatic Biota: 1996 Revision. Risk Assessment , Health Sciences Research Division, Oak Ridge, Tennessee, ES/ER/TM-96/R2.
out = excluded from further consideration in surface water
in = selected as a COPC

Table 5-2
Comparison of Maximum Sediment Concentrations to Sediment Quality Guidelines
Sauget Area I

Compounds	Maximum Detected[4]	Sediment Quality Guidelines[1] TEC	Florida SQAG[2] TEL	Ontario Guidelines[3] LEL	Maximum Detected in Reference Area[4]	Twice Average of Reference Area	Preliminary Screening	Comment
Herbicides (ug/kg)								
2,4,5-T								
2,4,5-TP (Silvex)								
2,4-D	23				12	20	IN	No criteria; greater than background
2,4-DB							OUT	Not detected in sediment.
Dalapon							OUT	Not detected in sediment.
Dicamba							OUT	Not detected in sediment.
Dichloroprop							OUT	Not detected in sediment.
Dinoseb							OUT	Not detected in sediment.
MCPA							OUT	Not detected in sediment.
MCPP							OUT	Not detected in sediment.
Pentachlorophenol					1.9		OUT	Not detected in sediment.
Metals mg/kg								
Aluminum	17000				19000	29000	OUT	No criteria; less than background
Antimony	4.7				4	4.2	IN	No criteria; greater than background
Arsenic	19	9.79	7.24	6	8	14.35	IN	Greater than criteria and background
Barium	420				230	415	IN	No criteria; greater than background
Beryllium	0.89				1	1.56	OUT	No criteria; less than background
Cadmium	47	0.99	0.676	0.6	0.65	0.83	IN	Greater than criteria and background
Calcium	17000				18000	27000	OUT	Common nutrient; less than background
Chromium	38	43.4	52.3	26	25	40	IN	Greater than criteria.
Cobalt	13			50	10	17.2	OUT	Less than criteria.
Copper	410	31.6	18.7	16	23	38	IN	Greater than criteria and background
Cyanide, Total				0.1			OUT	Not detected in sediment.
Iron	38000			20000	24000	41500	IN	Greater than criteria
Lead	320	35.8	30.2	31	26	44	IN	Greater than criteria and background
Magnesium	6800				6500	10300	OUT	Common nutrient.
Manganese	1400			460	770	1415	IN	Greater than criteria.
Mercury	1.1	0.18	0.13	0.2	0.063	0.096	IN	Greater than criteria and background
Molybdenum	3.7				0.53	0.89	IN	No criteria; greater than background
Nickel	390	22.7	15.9	16	26	43	IN	Greater than criteria; greater than background
Potassium	2900				2600	4200	OUT	Common nutrient
Selenium							OUT	Not detected in sediment.
Silver	0.79		0.733	0.5			IN	Greater than criteria
Sodium							OUT	Not detected in sediment.
Thallium							OUT	Not detected in sediment.
Vanadium	51				44	70	OUT	No criteria; less than background
Zinc	3700	121	124	120	96	166	IN	Greater than criteria and background
pH	7.06				7.31		OUT	NA
Total Organic Carbon (mg/kg dry weight)	140000				23000	34000	OUT	NA

Table 5-2
Comparison of Maximum Sediment Concentrations to Sediment Quality Guidelines
Sauget Area I

Compounds	Maximum Detected[4]	Sediment Quality Guidelines[1] TEC	Florida SQAG[2] TEL	Ontario Guidelines[3] LEL	Maximum Detected in Reference Area[4]	Twice Average of Reference Area	Preliminary Screening	Comment
PCBs and Pesticides ug/kg								
Decachlorobiphenyl							OUT	Not detected in sediment.
Dichlorobiphenyl							OUT	Not detected in sediment.
Heptachlorobiphenyl							OUT	Not detected in sediment.
Hexachlorobiphenyl	22						NA	
Monochlorobiphenyl							OUT	Not detected in sediment.
Nonachlorobiphenyl							OUT	Not detected in sediment.
Octachlorobiphenyl							OUT	Not detected in sediment.
Pentachlorobiphenyl	66						NA	
Tetrachlorobiphenyl							OUT	Not detected in sediment.
Trichlorobiphenyl							OUT	Not detected in sediment.
Total PCBs	83	59.8	21.6	70			IN	Greater than criteria; ND in background
4,4'-DDD	3.8	4.82	1.22	8			IN	Greater than criteria; ND in background
4,4'-DDE	11	3.16	2.07	5			IN	Greater than criteria; ND in background
4,4'-DDT*	4.5	4.16	1.19	8			IN	Greater than criteria; ND in background
Total DDT	43	5.28	3.89	7			IN	Greater than criteria; ND in background
Aldrin	4.1			2			IN	Greater than criteria; ND in background
Alpha Chlordane**	5.3	3.24	2.26	7			IN	Greater than criteria; ND in background
alpha-BHC				6			OUT	Not detected in sediment.
beta-BHC				5			OUT	Not detected in sediment.
delta-BHC	0.34						IN	No criteria; ND in background
Dieldrin	9.3	1.9	0.715	2			IN	Greater than criteria; ND in background
Endosulfan I	5.7						IN	No criteria; ND in background
Endosulfan II	8.1						IN	No criteria; ND in background
Endosulfan sulfate	9.5						IN	No criteria; ND in background
Endrin	1.7	2.22		3			OUT	Less than criteria.
Endrin aldehyde	14						IN	No criteria; ND in background
Endrin ketone	10						IN	No criteria; ND in background
Gamma Chlordane**	17	3.24	2.26	7			IN	Greater than criteria; ND in background
gamma-BHC (Lindane)	4.8	2.37	0.32	3			in	Greater than criteria; ND in background
Heptachlor	0.93			0.3 NEL			in	Greater than criteria; ND in background
Heptachlor epoxide	5.4	2.47		5			in	Greater than criteria; ND in background
Methoxychlor	24						IN	No criteria; ND in background
Toxaphene							OUT	Not detected in sediment.

Table 5-2
Comparison of Maximum Sediment Concentrations to Sediment Quality Guidelines
Sauget Area I

Compounds	Maximum Detected[4]	Sediment Quality Guidelines[1] TEC	Florida SQAG[2] TEL	Ontario Guidelines[3] LEL	Maximum Detected in Reference Area[4]	Twice Average of Reference Area	Preliminary Screening	Comment
SVOCs ug/kg								
1,2,4-Trichlorobenzene							OUT	Not detected in sediment.
1,2-Dichlorobenzene							OUT	Not detected in sediment.
1,3-Dichlorobenzene							OUT	Not detected in sediment.
1,4-Dichlorobenzene							OUT	Not detected in sediment.
2,2'-Oxybis(1-Chloropropane)							OUT	Not detected in sediment.
2,4,5-Trichlorophenol							OUT	Not detected in sediment.
2,4,6-Trichlorophenol							OUT	Not detected in sediment.
2,4-Dichlorophenol							OUT	Not detected in sediment.
2,4-Dinitrophenol							OUT	Not detected in sediment.
2,4-Dinitrotoluene							OUT	Not detected in sediment.
2,6-Dinitrotoluene							OUT	Not detected in sediment.
2-Chloronaphthalene							OUT	Not detected in sediment.
2-Chlorophenol							OUT	Not detected in sediment.
2-Methylnaphthalene			20.2				OUT	Not detected in sediment.
2-Methylphenol (o-cresol)							OUT	Not detected in sediment.
2-Nitroaniline							OUT	Not detected in sediment.
2-Nitrophenol							OUT	Not detected in sediment.
3,3'-Dichlorobenzidine							OUT	Not detected in sediment.
3-Methylphenol/4-Methylphenol							OUT	Not detected in sediment.
3-Nitroaniline							OUT	Not detected in sediment.
4,6-Dinitro-2-methylphenol							OUT	Not detected in sediment.
4-Bromophenylphenyl ether							OUT	Not detected in sediment.
4-Chloro-3-methylphenol							OUT	Not detected in sediment.
4-Chloroaniline							OUT	Not detected in sediment.
4-Chlorophenylphenyl ether							OUT	Not detected in sediment.
4-Nitroaniline							OUT	Not detected in sediment.
4-Nitrophenol							OUT	Not detected in sediment.
Acenaphthene			6.71				OUT	Not detected in sediment.
Acenaphthylene			5.87				OUT	Not detected in sediment.
Anthracene		57.2	46.9	220			OUT	Not detected in sediment.
Benzo(a)anthracene		108	74.8	320			OUT	Not detected in sediment.
Benzo(a)pyrene		150	88.8	370			OUT	Not detected in sediment.
Benzo(b)fluoranthene							OUT	Not detected in sediment.
Benzo(g,h,i)perylene				170			OUT	Not detected in sediment.
Benzo(k)fluoranthene				240			OUT	Not detected in sediment.
bis(2-Chloroethoxy)methane							OUT	Not detected in sediment.
bis(2-Chloroethyl)ether							OUT	Not detected in sediment.
bis(2-Ethylhexyl)phthalate			182				OUT	Not detected in sediment.
Butylbenzylphthalate							OUT	Not detected in sediment.
Carbazole							OUT	Not detected in sediment.

Table 5-2
Comparison of Maximum Sediment Concentrations to Sediment Quality Guidelines
Sauget Area I

Compounds	Maximum Detected[4]	Sediment Quality Guidelines[1] TEC	Florida SQAG[2] TEL	Ontario Guidelines[3] LEL	Maximum Detected in Reference Area[4]	Twice Average of Reference Area	Preliminary Screening	Comment
Chrysene	74	166	108	340			OUT	Less than criteria; ND in background
Di-n-butylphthalate							OUT	Not detected in sediment.
Di-n-octylphthalate							OUT	Not detected in sediment.
Dibenzo(a,h)anthracene		33	6.22	60			OUT	Not detected in sediment.
Dibenzofuran							OUT	Not detected in sediment.
Diethylphthalate							OUT	Not detected in sediment.
Dimethylphthalate							OUT	Not detected in sediment.
Fluoranthene	130	423	113	750			IN	Greater than criteria; ND in background
Fluorene		77.4	21.2	190			OUT	Not detected in sediment.
Hexachlorobenzene							OUT	Not detected in sediment.
Hexachlorobutadiene							OUT	Not detected in sediment.
Hexachlorocyclopentadiene							OUT	Not detected in sediment.
Hexachloroethane							OUT	Not detected in sediment.
Indeno(1,2,3-cd)pyrene				200			OUT	Not detected in sediment.
Isophorone							OUT	Not detected in sediment.
N-Nitroso-di-n-propylamine							OUT	Not detected in sediment.
N-Nitrosodiphenylamine							OUT	Not detected in sediment.
Naphthalene		176	34.6				OUT	Not detected in sediment.
Nitrobenzene							OUT	Not detected in sediment.
Pentachlorophenol							OUT	Not detected in sediment.
Phenanthrene		204	86.7	560			OUT	Not detected in sediment.
Phenol							OUT	Not detected in sediment.
Pyrene		195	153	490			OUT	Not detected in sediment.
Total PAHs	130	1610	1684	4000			OUT	Less than criteria
VOCs ug/kg								
1,1,1-Trichloroethane							OUT	Not detected in sediment.
1,1,2,2-Tetrachloroethane							OUT	Not detected in sediment.
1,1,2-Trichloroethane							OUT	Not detected in sediment.
1,1-Dichloroethane							OUT	Not detected in sediment.
1,1-Dichloroethene							OUT	Not detected in sediment.
1,2-Dichloroethane							OUT	Not detected in sediment.
1,2-Dichloropropane							OUT	Not detected in sediment.
2-Butanone (MEK)					40	49.75	OUT	Not detected in sediment.
2-Hexanone							OUT	Not detected in sediment.
4-Methyl-2-pentanone (MIBK)							OUT	Not detected in sediment.
Acetone					160	155.75	OUT	Not detected in sediment.
Benzene							OUT	Not detected in sediment.
Bromodichloromethane							OUT	Not detected in sediment.
Bromoform							OUT	Not detected in sediment.
Bromomethane (Methyl bromide)							OUT	Not detected in sediment.

Table 5-2
Comparison of Maximum Sediment Concentrations to Sediment Quality Guidelines
Sauget Area I

Compounds	Maximum Detected[4]	Sediment Quality Guidelines[1] TEC	Florida SQAG[2] TEL	Ontario Guidelines[3] LEL	Maximum Detected in Reference Area[4]	Twice Average of Reference Area	Preliminary Screening	Comment
Carbon disulfide							OUT	Not detected in sediment.
Carbon tetrachloride							OUT	Not detected in sediment.
Chlorobenzene							OUT	Not detected in sediment.
Chloroethane							OUT	Not detected in sediment.
Chloroform							OUT	Not detected in sediment.
Chloromethane							OUT	Not detected in sediment.
cis-1,3-Dichloropropene							OUT	Not detected in sediment.
Cis/Trans-1,2-Dichloroethene							OUT	Not detected in sediment.
Dibromochloromethane							OUT	Not detected in sediment.
Ethylbenzene	11						IN	No criteria; ND in background
Methylene chloride (Dichloromethane)							OUT	Not detected in sediment.
Styrene							OUT	Not detected in sediment.
Tetrachloroethene							OUT	Not detected in sediment.
Toluene							OUT	Not detected in sediment.
trans-1,3-Dichloropropene							OUT	Not detected in sediment.
Trichloroethene							OUT	Not detected in sediment.
Vinyl chloride							OUT	Not detected in sediment.
Xylenes, Total							OUT	Not detected in sediment.
Dioxin TEQ (mammal) pg/g	333				10	12	IN	Greater than reference area.

Notes: Except where noted, concentrations in ug/kg for organic constituens; mg/kg for inorganic constituents.

[1] Threshold Effects Concentration - MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Arch. Environ. Contam. Toxicol.* 39:20-31.

[2] Sediment Quality Assessment Guidelines - MacDonald Environmental Sciences, Ltd. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters, Volume 1– Development and Evaluation of Sediment Quality Assessment Guidelines. Prepared for

[3] Lowest Effects Level - Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of Environment and Energy. August 1993.

[4] A blank in this column indicates that compound was not detected in sediment in this location

* Ontario and Sediment Quality Guideline values are for 2,4'-DDT and 4,4'-DDT

** Florida, Ontario, and Sediment Quality Guideline values are for Chlordane

OUT = excluded from further consideration in sediment

IN = selected as COPC

Table 5-3
Selection of COPCs for Ecological Risk Assessment
Sauget Area I

Compounds	Maximum Detected Sediment	Sediment Screened In	Maximum Detected in Surface Water	Surface Water Screened In	Maximum Detected LMB Site	Max Detected LMB Reference Area	Maximum Detected BB Site	Max detected BB Reference Area	Maximum Detected Clam Site	Max detected Clam Reference Area	Maximum Detected Forage Fish Site	Max detected Forage Fish Reference Area	Maximum Detected Plants Site	Max Detected Plants Reference Area	Maximum Detected Shrimp Site	Max Detected Shrimp Reference Area	Selected as COPC
2,4,5-T																	NO
2,4,5-TP (Silvex)																1.3	NO
2,4-D	23	IN															YES
2,4-DB											10	10					NO
Dalapon																	NO
Dicamba					1.9						2.6	5.1		1.8			YES
Dichloroprop							6.6		32	87	6.7		7				YES
Dinoseb																	NO
MCPA					1800			8600		1400	3300	2400					YES
MCPP									4000					1300		4400	YES
Pentachlorophenol											2.2	2.2		2	1.8	3.9	NO
Aluminum	17000		3.4	IN	33	81	18	66	13	26	52	100	44	160	28	100	YES
Antimony	4.7	IN											0.13		0.16		YES
Arsenic	19	IN	0.015						0.96	0.65			0.58	1.1		1.2	YES
Barium	420	IN	0.32	IN													YES
Beryllium	0.89																NO
Cadmium	47	IN							0.12	0.61							YES
Calcium	17000		89														NO
Chromium	38	IN	0 0041		0.93	0.36	0.7	0.48	1.1	2.2	0.32	1.7	0.097	0.53	0.23	0.28	YES
Cobalt	13		0.0015														NO
Copper	410	IN	0.012		0.68	0.84	0.89	1.1	0.99	2.4	1.7	0.75	2.1	1 3	8.3	16	YES
Cyanide, Total																	NO
Iron	38000	IN	8.7	IN													YES
Lead	320	IN	0.02	IN	0.064		0.25	0.23	0.25	0.59	0.59	0.37	2.1	0.64	0.39	0.61	YES
Magnesium	6800		33														NO
Manganese	1400	IN	1.7	IN													YES
Mercury	1.1	IN				0.14	0.26	0.1			0.6	0.064					YES
Molybdenum	3.7	IN	0.004														YES
Nickel	390	IN	0.021										2.6				YES
Potassium	2900		7 6														NO
Selenium					0.63	0.86		0.5		0.48	0.54	0.65				0.61	NO
Silver	0.79	IN							0.02						0.09	0.062	YES
Sodium			24														NO
Thallium																	NO
Vanadium	51		0.014														NO
Zinc	3700	IN	0 075		19	15	22	24	22	52	33	33	26	8.3	16	17	YES
Decachlorobiphenyl																	
Dichlorobiphenyl																	
Heptachlorobiphenyl					21												
Hexachlorobiphenyl	22	IN			150	9.3	52				22						
Monochlorobiphenyl																	
Nonachlorobiphenyl																	
Octachlorobiphenyl																	
Pentachlorobiphenyl	66	IN			130	9.5	52				8.7					22	
Tetrachlorobiphenyl					46												
Trichlorobiphenyl																	
Total PCBs	83	IN															YES

Compounds	Maximum Detected Sediment	Sediment Screened In	Maximum Detected in Surface Water	Surface Water Screened In	Maximum Detected LMB Site	Max Detected LMB Reference Area	Maximum Detected BB Site	Max detected BB Reference Area	Maximum Detected Clam Site	Max detected Clam Reference Area	Maximum Detected Forage Fish Site	Max detected Forage Fish Reference Area	Maximum Detected Plants Site	Max Detected Plants Reference Area	Maximum Detected Shrimp Site	Max Detected Shrimp Reference Area	Selected as COPC
4,4'-DDD	3.8	IN						2									YES
4,4'-DDE	11	IN			21	6.6	29	12			10	3.5					YES
4,4'-DDT	4.5	IN															YES
Total DDT	43	IN															YES
Aldrin	4.1	IN												1			YES
Alpha Chlordane	5.3	IN					12	2.5					0.81				YES
alpha-BHC			0.001														NO
beta-BHC			0.02														NO
delta-BHC	0.34	IN	0.0022														YES
Dieldrin	9.3	IN	0.001			5.6		3.8				4.7					YES
Endosulfan I	5.7	IN	0.0024														YES
Endosulfan II	8.1	IN															YES
Endosulfan sulfate	9.5	IN	0.0032														YES
Endrin	1.7		0.00095					2.6									NO
Endrin aldehyde	14	IN	0.0032														YES
Endrin ketone	10	IN	0.0027														YES
Gamma Chlordane	17	IN			19		11	6.2				1.2	3.1				YES
gamma-BHC (Lindane)	4.8	IN	0.0038					1.2									YES
Heptachlor	0.93	IN	0.0029		1.5		2.8		2.3				1.9	3.8			YES
Heptachlor epoxide	5.4	IN	0.00096														YES
Methoxychlor	24	IN							5.4								YES
Toxaphene																	NO
1,2,4-Trichlorobenzene																	NO
1,2-Dichlorobenzene																	NO
1,3-Dichlorobenzene																	NO
1,4-Dichlorobenzene																	NO
2,2'-Oxybis(1-Chloropropane)																	NO
2,4,5-Trichlorophenol																	NO
2,4,6-Trichlorophenol																	NO
2,4-Dichlorophenol																	NO
2,4-Dinitrophenol																	NO
2,4-Dinitrotoluene																	NO
2,6-Dinitrotoluene																	NO
2-Chloronaphthalene																	NO
2-Chlorophenol																	NO
2-Methylnaphthalene																	NO
2-Methylphenol (o-cresol)																	NO
2-Nitroaniline																	NO
2-Nitrophenol																	NO
3,3'-Dichlorobenzidine																	NO
3-Methylphenol/4-Methylphenol																	NO
3-Nitroaniline																	NO
4,6-Dinitro-2-methylphenol																	NO
4-Bromophenylphenyl ether																	NO
4-Chloro-3-methylphenol																	NO
4-Chloroaniline																	NO
4-Chlorophenylphenyl ether																	NO
4-Nitroaniline																	NO
4-Nitrophenol																	NO
Acenaphthene																	NO
Acenaphthylene													32				YES
Anthracene																	NO
Benzo(a)anthracene																	NO
Benzo(a)pyrene													140	37			YES
Benzo(b)fluoranthene													59	18			YES
Benzo(g,h,i)perylene													360	390			NO
Benzo(k)fluoranthene													52	21			YES
bis(2-Chloroethoxy)methane																	NO
bis(2-Chloroethyl)ether																	NO
bis(2-Ethylhexyl)phthalate							97	47	170	73	230	280				98	YES
Butylbenzylphthalate																	NO
Carbazole																	NO
Chrysene	74																NO

Table 5-3
Selection of COPCs for Ecological Risk Assessment
Sauget Area I

Compounds	Maximum Detected Sediment	Sediment Screened In	Maximum Detected in Surface Water	Surface Water Screened In	Maximum Detected LMB Site	Max Detected LMB Reference Area	Maximum Detected BB Site	Max detected BB Reference Area	Maximum Detected Clam Site	Max detected Clam Reference Area	Maximum Detected Forage Fish Site	Max detected Forage Fish Reference Area	Maximum Detected Plants Site	Max Detected Plants Reference Area	Maximum Detected Shrimp Site	Max Detected Shrimp Reference Area	Selected as COPC
Di-n-butylphthalate					32	20											YES
Di-n-octylphthalate																	NO
Dibenzo(a,h)anthracene											48		76	400			YES
Dibenzofuran																	NO
Diethylphthalate							18	25	120	59	37	37			44	59	YES
Dimethylphthalate																	NO
Fluoranthene	130	IN	0.7														YES
Fluorene																	NO
Hexachlorobenzene																	NO
Hexachlorobutadiene																	NO
Hexachlorocyclopentadiene																	NO
Hexachloroethane																	NO
Indeno(1,2,3-cd)pyrene											54		300	440			YES
Isophorone																	NO
N-Nitroso-di-n-propylamine																	NO
N-Nitrosodiphenylamine																	NO
Naphthalene																	NO
Nitrobenzene																	NO
Pentachlorophenol																	NO
Phenanthrene			0.7														NO
Phenol																	NO
Pyrene																	NO
Total PAHs			0.7														NO
1,1,1-Trichloroethane																	NO
1,1,2,2-Tetrachloroethane																	NO
1,1,2-Trichloroethane																	NO
1,1-Dichloroethane																	NO
1,1-Dichloroethene																	NO
1,2-Dichloroethane																	NO
1,2-Dichloropropane																	NO
2-Butanone (MEK)																	NO
2-Hexanone																	NO
4-Methyl-2-pentanone (MIBK)																	NO
Acetone			18														NO
Benzene			1.7														NO
Bromodichloromethane																	NO
Bromoform																	NO
Bromomethane (Methyl bromide)																	NO
Carbon disulfide																	NO
Carbon tetrachloride																	NO
Chlorobenzene																	NO
Chloroethane																	NO
Chloroform																	NO
Chloromethane																	NO
cis-1,3-Dichloropropene																	NO
Cis/Trans-1,2-Dichloroethene																	NO
Dibromochloromethane																	NO
Ethylbenzene	11	IN															NO
Methylene chloride (Dichloromethane)																	NO
Styrene																	NO
Tetrachloroethene																	NO
Toluene																	NO
trans-1,3-Dichloropropene																	NO
Trichloroethene																	NO
Vinyl chloride																	NO
Xylenes, Total																	NO
Dioxins		IN		IN	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes	Yes	YES

LMB = Largemouth Bass
BB = Brown Bullhead
2,4-Dimethylphenol was also detected in Site plants at 51 ug/kg
Concentrations in ug/kg except metals which are in mg/kg

Table 7-1
Comparison of Largemouth Bass Concentrations to Toxicity Benchmarks
Sauget Area I

Compound	Benchmark	Site Maximum	Site Average	Reference Maximum	Reference Average
Herbicides (ug/kg)		ND	ND	ND	ND
2,4-D	NA	ND	ND	ND	ND
Dicamba	NA	1.9	5.6	ND	ND
Dichloroprop	NA	ND	ND	ND	ND
MCPA	NA	1800	1267	ND	ND
MCPP	NA	ND	ND	ND	ND
Metals (mg/kg)					
Aluminum, Total	NA	33	20	81	41
Antimony	NA	ND	ND	ND	ND
Arsenic, Total	0.52	ND	ND	ND	ND
Barium, Total	NA	ND	ND	ND	ND
Cadmium, Total	0.5	ND	ND	ND	ND
Chromium, Total	NA	0.93	0.64	0.36	0.28
Copper, Total	12.1	0.68	0.54	0.8	0.5
Iron	NA	ND	ND	ND	ND
Lead, Total	26.2	ND	ND	ND	ND
Manganese	NA	ND	ND	ND	ND
Mercury	0.25	0.064	0.043	0.1	0.1
Molybdenum	NA	ND	ND	ND	ND
Nickel, Total	NA	ND	ND	ND	ND
Silver	NA	ND	ND	ND	ND
Zinc, Total	NA	19	17	15	11
Total PCBs (ug/kg)	950	320	237	ND	ND
Pesticides (ug/kg)					
4,4'-DDD	600	ND	ND	ND	ND
4,4'-DDE	29200	21	14	6.6	5.3
4,4'-DDT	3800	ND	ND	ND	ND
Aldrin	157	ND	ND	ND	ND
Alpha Chlordane	16600 [a]	ND	ND	ND	ND
delta-BHC	NA	ND	ND	ND	ND
Dieldrin	3700	ND	ND	5.6	5.0
Endosulfan I	195 [b]	ND	ND	ND	ND
Endosulfan II	195 [b]	ND	ND	ND	ND
Endosulfan sulfate	195 [b]	ND	ND	ND	ND
Endrin aldehyde	150 [c]	ND	ND	ND	ND
Endrin ketone	150 [c]	ND	ND	ND	ND
Gamma Chlordane	16600 [a]	19	12	ND	ND
gamma-BHC (Lindane)	NA	ND	ND	ND	ND
Heptachlor	5700	1.5	2.8	ND	ND
Heptachlor epoxide	3200	ND	ND	ND	ND
Methoxychlor	128	ND	ND	ND	ND
SVOC (ug/kg)					
bis(2-ethylhexyl)phthalate	NA	ND	ND	ND	ND
Di-n-butylphthalate	NA	32	67	20	52
Diethylphthalate	NA	ND	ND	ND	ND
Acenaphthylene	NA	ND	ND	ND	ND
Fluoranthene	NA	ND	ND	ND	ND
Benzo(b)fluoranthene	NA	ND	ND	ND	ND
Benzo(k)fluoranthene	NA	ND	ND	ND	ND
Benzo(a)pyrene	28.3	ND	ND	ND	ND
Benzo(a)pyrene	23.9	ND	ND	ND	ND
Indeno(1,2,3-c-d)pyrene	NA	ND	ND	ND	ND
Dibenz(a,h)anthracene	NA	ND	ND	ND	ND
2,3,7,8-TCDD, TEQ, ug/kg	0.05	0.003 *	0.0021 *	0.00019*	0.00011*

* Maximum and Average TEQs for fish were used for comparison to benchmark.
a Benchmark value is for Chlordane
b Benchmark value for Endosulfan was used
c Benchmark values for Endrin were used

Table 7-2
Comparison of Brown Bullhead Concentrations to Toxicity Benchmarks
Sauget Area I

Compound	Benchmark	Site Maximum	Site Average	Reference Maximum	Reference Average
Herbicides (ug/kg)					
2,4-D	NA	ND	ND	ND	ND
Dicamba	NA	ND	ND	ND	ND
Dichloroprop	NA	6.6	35.5	ND	ND
MCPA	NA	ND	ND	8600	3533
MCPP	NA	ND	ND	ND	ND
Metals (mg/kg)					
Aluminum, Total	NA	18	13	66	34
Antimony	NA	ND	ND	ND	ND
Arsenic, Total	0.52	ND	ND	ND	ND
Barium, Total	NA	ND	ND	ND	ND
Cadmium, Total	0.5	ND	ND	ND	ND
Chromium, Total	NA	0.7	0.4	0.5	0.4
Copper, Total	12.1	0.89	0.84	1	1
Iron	NA	ND	ND	ND	ND
Lead, Total	26.2	0.25	0.24	0.23	0.21
Manganese	NA	ND	ND	ND	ND
Mercury	0.25	0.3	0.1	0.1	0.08
Molybdenum	NA	ND	ND	ND	ND
Nickel, Total	NA	ND	ND	ND	ND
Silver	NA	ND	ND	ND	ND
Zinc, Total	NA	22	20	24	20
Total PCBs (ug/kg)	950	102	63	ND	ND
Pesticides (ug/kg)					
4,4'-DDD	600	ND	ND	1.8	5.3
4,4'-DDE	29200	29	18	12	8.8
4,4'-DDT	3800	ND	ND	ND	ND
Aldrin	157	ND	ND	ND	ND
Alpha Chlordane	16600 [a]	12	7	2.5	1.6
delta-BHC	NA	ND	ND	ND	ND
Dieldrin	3700	ND	ND	3.8	2.8
Endosulfan I	195 [b]	ND	ND	ND	ND
Endosulfan II	195 [b]	ND	ND	ND	ND
Endosulfan sulfate	165 [b]	ND	ND	ND	ND
Endrin aldehyde	150 [c]	ND	ND	ND	ND
Endrin ketone	150 [c]	ND	ND	ND	ND
Gamma Chlordane	16600 [a]	11	7	6.2	6.4
gamma-BHC (Lindane)	NA	ND	ND	1.2	3.0
Heptachlor	5700	2.8	3.2	ND	ND
Heptachlor epoxide	3200	ND	ND	ND	ND
Methoxychlor	128	ND	ND	ND	ND
SVOC (ug/kg)					
bis(2-ethylhexyl)phthalate	NA	97	89	47	59
Di-n-butylphthalate	NA	ND	ND	ND	ND
Diethylphthalate	NA	18	63	25	65
Acenaphthylene	NA	ND	ND	ND	ND
Fluoranthene	NA	ND	ND	ND	ND
Benzo(b)fluoranthene	NA	ND	ND	ND	ND
Benzo(k)fluoranthene	NA	ND	ND	ND	ND
Benzo(a)pyrene	28.3	ND	ND	ND	ND
Benzo(a)pyrene	23.9	ND	ND	ND	ND
Indeno(1,2,3-c-d)pyrene	NA	ND	ND	ND	ND
Dibenz(a,h)anthracene	NA	ND	ND	ND	ND
2,3,7,8-TCDD, TEQ, ug/kg	0.05	0.003 *	0.002 *	0.00069*	0.00045*

*Maximum and Average TEQs for fish were used for comparison to benchmarks
a Benchmark value is for Chlordane
b Benchmark value for Endosulfan was used
c Benchmark values for Endrin were used

Table 7-3
Comparison of Forage Fish Concentrations to Toxicity Benchmarks
Sauget Area I

Compound	Benchmark	Site Maximum	Site Average	Reference Maximum	Reference Average
Herbicides (ug/kg)					
2,4-D	NA	ND	ND	ND	ND
Dicamba	NA	2.6	11	ND	ND
Dichloroprop	NA	6.7	52.2	5.1	39
MCPA	NA	3300	2800	2400	1350
MCPP	NA	ND	ND	ND	ND
Metals (mg/kg)					
Aluminum, Total	NA	52	40	100	50
Antimony	NA	ND	ND	ND	ND
Arsenic, Total	0.52	ND	ND	ND	ND
Barium, Total	NA	ND	ND	ND	ND
Cadmium, Total	0.5	ND	ND	ND	ND
Chromium, Total	NA	0.3	0.3	1.7	0.71
Copper, Total	12.1	2	1	0.75	0.54
Iron	NA	ND	ND	ND	ND
Lead, Total	26.2	0.59	0.36	0.4	0.3
Manganese	NA	ND	ND	ND	ND
Mercury	0.25	0.6	0.2	0.064	0.053
Molybdenum	NA	ND	ND	ND	ND
Nickel, Total	NA	ND	ND	ND	ND
Silver	NA	ND	ND	ND	ND
Zinc, Total	NA	33	30	33	26
Total PCBs (ug/kg)	950	39	30	ND	ND
Pesticides (ug/kg)					
4,4'-DDD	*600*	*ND*	*ND*	ND	*ND*
4,4'-DDE	29200	10	7.7	3.5	4.9
4,4'-DDT	3800	ND	ND	ND	ND
Aldrin	157	ND	ND	ND	ND
Alpha Chlordane	16600 [a]	ND	ND	ND	ND
delta-BHC	NA	ND	ND	ND	ND
Dieldrin	3700	ND	ND	4.7	5.4
Endosulfan I	195 [b]	ND	ND	ND	ND
Endosulfan II	195 [b]	ND	ND	ND	ND
Endosulfan sulfate	NA	ND	ND	ND	ND
Endrin aldehyde	150 [c]	ND	ND	ND	ND
Endrin ketone	150 [c]	ND	ND	ND	ND
Gamma Chlordane	16600 [a]	ND	ND	1.2	3.2
gamma-BHC (Lindane)	NA	ND	ND	ND	ND
Heptachlor	5700	ND	ND	ND	ND
Heptachlor epoxide	3200	ND	ND	ND	ND
Methoxychlor	128	ND	ND	ND	ND
SVOC (ug/kg)					
bis(2-ethylhexyl)phthalate	NA	230	183	280	172
Di-n-butylphthalate	NA	ND	ND	ND	ND
Diethylphthalate	NA	37	31	37	61.3
Acenaphthylene	NA	ND	ND	ND	ND
Fluoranthene	NA	ND	ND	ND	ND
Benzo(b)fluoranthene	NA	ND	ND	ND	ND
Benzo(k)fluoranthene	NA	ND	ND	ND	ND
Benzo(a)pyrene	28.3	ND	ND	ND	ND
Benzo(a)pyrene	23.9	ND	ND	ND	ND
Indeno(1,2,3-c-d)pyrene	NA	54	103	ND	ND
Dibenz(a,h)anthracene	NA	48	101	ND	ND
2,3,7,8-TCDD, TEQ, ug/kg	0.05	0.001 *	0.00085 *	0.0014	0.00096

* Maximum and Average TEQs for fish was used for comparison to benchmark
a Benchmark value is for Chlordane
b Benchmark value for Endosulfan was used
c Benchmark values for Endrin were used

Table 7-4
Whole Body Toxicity Values for Fish
Sauget Area 1

Compound	Species Common Name	Chemical Common Name	Concentration -Wet (mg/kg)	Reps	Effect	Endpoint	Exposure Route	Body Part	Start Life Stage
Arsenic	Bluegill	Arsenic	0.52	5	Mortality	NOED	Absorption	Whole Body	Immature
Cadmium	Guppy	Cadmium	0.5	2	Growth	LOED	Ingestion	Whole Body	Immature
Copper	Common carp	Copper	12.1	1	Morphology; Mortality	LOED	Combined	Whole Body	Egg
	Common carp	Copper	12.1	1	Reproduction	NOED	Combined	Whole Body	Egg
Lead	Fathead minnow	Lead	26.2	1	Behavior	LOED	Absorption	Whole Body	Immature
	Fathead minnow	Lead	26.2	1	Behavior, Physiological	NOED	Absorption	Whole Body	Immature
Mercury	Walleye	Mercury	0.25	22	Cellular, Developmental, Physiological	LOED	Ingestion	Whole Body	Immature
	Walleye	Mercury	0.25	22	Mortality	NOED	Ingestion	Whole Body	Immature
PCBs									
	Catfish-Channel	PCBs	14.3	3	Growth, Morphology	LOED	Ingestion	Whole Body	Immature
	Pinfish	PCBs	2.2	2	Mortality	LOED	Absorption	Whole Body	Immature
	Pinfish	PCBs	0.98	10	Mortality	NOED	Absorption	Whole Body	Immature
	Pinfish	PCBs	3.8	10	Mortality	NOED	Absorption	Whole Body	Immature
	Catfish-Channel	PCBs	10.9	3	Mortality	NOED	Ingestion	Whole Body	Immature
	Catfish-Channel	PCBs	14.3	3	Mortality	NOED	Ingestion	Whole Body	Immature
	Redbreast sunfish	PCBs	***0.95***	field study	Reproduction; Growth	NOED	Field study	Whole Body	Adult
	Redbreast sunfish	PCBs	***0.95***	field study	Reproduction; Growth	NOED	Field study	Whole Body	Adult
	Redbreast sunfish	PCBs	***0.95***	field study	Reproduction; Growth	NOED	Field study	Whole Body	Adult
DDD	Fathead minnow	4,4`-DDD	0.6	1	Reproduction	LOED	Combined	Whole Body	Adult
DDE	Mosquito fish	4,4`-DDE	29.2	1	Mortality	NOED	Combined	Whole Body	NA
DDT	Fathead minnow	4,4`-DDT	3.8	1	Reproduction	LOED	Combined	Whole Body	Adult
Aldrin	Mosquito fish	Aldrin	0.157	1	Mortality	NOED	Combined	Whole Body	NA
Dieldrin	Bluegill	Dieldrin	3.7	5	Behavior	LOED	Absorption	Whole Body	Immature
Endosulfan	Pinfish	Endosulfan	0.195	1	Mortality	NOED	Combined	Whole Body	Mature
Endrin	Golden Shiner	Endrin	***0.15***	3	Behavior	LOED	Absorption	Whole Body	NA
	Mosquito fish	Endrin	3.4	1	Mortality	LOED	Combined	Whole Body	NA
	Catfish-Channel	Endrin	0.41	1	Mortality	NOED	Absorption	Whole Body	Immature

Table 7-4
Whole Body Toxicity Values for Fish
Sauget Area 1

Compound	Species Common Name	Chemical Common Name	Concentration -Wet (mg/kg)	Reps	Effect	Endpoint	Exposure Route	Body Part	Start Life Stage
Chlordane	Pinfish	Chlordane	16.6	2	Mortality	LOED	Combined	Whole Body	Adult
Heptachlor	Pinfish	Heptachlor	5.7	1	Mortality	NOED	Combined	Whole Body	Mature
Heptachlor epoxide	Pinfish	Heptachlor epoxide	3.2	1	Mortality	NOED	Combined	Whole Body	Mature
Methoxychlor	Mosquito fish	Methoxychlor	0.128	1	Mortality	NOED	Combined	Whole Body	NA
Benzo(a)pyrene	Gizzard Shad	Benzo[a]pyrene	0.0283	2	Physiological	LOED	Absorption	Whole Body	Adult
	Gizzard Shad	Benzo[a]pyrene	***0.0239***	2	Physiological	NOED	Absorption	Whole Body	Adult
Dioxin	Common carp	2,3,7,8-TCDD	0.0022	1	Behavior, Cellular, Morphology, mortality	LOED	Absorption	Whole Body	Adult
	Yellow perch	2,3,7,8-TCDD	0.000143	6	Growth, Morphology, Mortality	NOED	Ingestion	Whole Body	Immature
	Lake trout	2,3,7,8-TCDD	***0.00005***	NA	Mortality	NOED	Absorption	Whole Body	Based on egg concentration

If multiple values are available; selected value is bold and in italics.

Table 7-4
Whole Body Toxicity Values for Fish
Sauget Area 1

Compound	Year	Author	Journal
Arsenic	1980	Barrows, M.E., S.R. Petrocelli, K.J. Macek and J.J. Carroll	p. 379-392 in Haque, R., ed. Dynamics, Exposure and Hazard Assessment of Toxic Chemicals
Cadmium	1982	Hatakeyama, S. and M. Yasuno	Bull. Environ. Contam. Toxicol. 29:159-166.
Copper	1996	Stouthart, J.H.X., Haans, J.L.M., Lock, R.A.C., Bonga, S.E.W.	Environmental Toxicology and Chemistry, Vol. 15, No. 3, pp. 376-383 (1996)
	1996	Stouthart, J.H.X., Haans, J.L.M., Lock, R.A.C., Bonga, S.E.W.	Environmental Toxicology and Chemistry, Vol. 15, No. 3, pp. 376-383 (1996)
Lead	1991	Weber, D.N., Russo, A., Seale, D.B., Spieler, R.E.	Aquatic Toxicol. 21: 71-80
	1991	Weber, D.N., Russo, A., Seale, D.B., Spieler, R.E.	Aquatic Toxicol. 21: 71-80
Mercury	1996	Friedmann, A.S., M.C. Watzin, T. Brinck-Johnsen and J.C. Leiter	Aquat. Toxicol. 35:265-278.
	1996	Friedmann, A.S., M.C. Watzin, T. Brinck-Johnsen and J.C. Leiter	Aquat. Toxicol. 35:265-278.
PCBs			
	1976	Hansen, L.G., W.B. Wiekhorst and J. Simon	J. Fish. Res. Bd. Can. 33:1343-1352.
	1974	Hansen, D.J., P.R. Parrish and J. Forester	Environ. Res. 7:363-373.
	1970	Duke, T.W., J.I. Lowe and A.J. Wilson, Jr.	Bull. Environ. Contam. Toxicol. 5:171-180.
	1970	Duke, T.W., J.I. Lowe and A.J. Wilson, Jr.	Bull. Environ. Contam. Toxicol. 5:171-180.
	1976	Hansen, L.G., W.B. Wiekhorst and J. Simon	J. Fish. Res. Bd. Can. 33:1343-1352.
	1976	Hansen, L.G., W.B. Wiekhorst and J. Simon	J. Fish. Res. Bd. Can. 33:1343-1352.
	1989	Adams, S.M., K.L. Shepard, M.S. Greeley Jr., B.D. Jimenez, M.G. Ryon, L.R. Ghugart, and J.F. McCarthy;	Marine Envirnmental Research. 28: 459-464.
	1990	Adams, S.M., L.R. Shugart, G.R. Southworth and D.E. Hinton	In J.F. McCarthy and L.R. Shugart, eds., Biomarkers of Environmental Contamination. Lewis Publishers, Boca Raton, FL., pp. 333-353.
	1992	Adams, S.M., W.D. Crumby, M.S. Greeley, Jr., M.G. Ryon, and E.M Schilling	Environmental Toxicology and Chemistry. 11: 1549-1557.
DDD	1977	Jarvinen, A.W., M.J. Hoffman, and T.W. Thorslund	J. Fish. Res. Board. Can. 34:2089-2103
DDE	1974	Metcalf, R.L.	p. 17-38 in Hayes, W.J., Essays in Toxicology, Volume 5. Academic Press
DDT	1977	Jarvinen, A.W., M.J. Hoffman, and T.W. Thorslund	J. Fish. Res. Board. Can. 34:2089-2103
Aldrin	1974	Metcalf, R.L.	p. 17-38 in Hayes, W.J., Essays in Toxicology, Volume 5. Academic Press
Dieldrin	1967	Gakstatter, J.H. and C.M. Weiss	Trans. Amer. Fish. Soc. 96:301-307.
Endosulfan	1977	Schimmel, S.C., Patrick, J.M., Wilson, A.J.	Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, American Society for Testing and Materials, pp. 241-252 (1977)
Endrin	1968	Ludke, J.L., D.E. Ferguson and W.D. Burke	Trans. Amer. Fish. Soc. 97:260-263.
	1973	Metcalf, R.L., I.P. Kapoor, P.Y. Lu, C.K. Schuth and P. Sherman	Environ. Health Perspect. 8:35-44.
	1973	Argyle, R.L., Williams, G.C., and H.K. Dupree	J. Fish. Res. Board Can. 30: 1743-1744

Table 7-4
Whole Body Toxicity Values for Fish
Sauget Area 1

Compound	Year	Author	Journal
Chlordane	1976	Parrish, P.R., S.C. Schimmel, D.J. Hansen, J.M. Patrick, and J. Forester	Journal of Toxicology and Environmental Health, 1:485-494, 1976
Heptachlor	1976	Schimmel, S.C., Patrick, J.M., Forester, J.	Journal of Toxicology and Environmental Health, 1:955-965, 1976
Heptachlor epoxide	1976	Schimmel, S.C., Patrick, J.M., Forester, J.	Journal of Toxicology and Environmental Health, 1:955-965, 1976
Methoxychlor	1974	Metcalf, R.L.	p. 17-38 in Hayes, W.J., Essays in Toxicology, Volume 5. Academic Press
Benzo(a)pyrene	1994	Levine, S.L., J.T. Oris and T.E. Wissing	Aquat. Toxicol. 30:61-75.
	1994	Levine, S.L., J.T. Oris and T.E. Wissing	Aquat. Toxicol. 30:61-75.
Dioxin	1991	Cook, P.M., D.W. Kuehl, M.K. Walker and R.E. Peterson	p. 143-167 in Gallow, M.A., et.al. Biol. Basis for Risk Assmt. of Dioxins and Related Compounds.
	1986	Kleeman, J.M., J.R. Olson, S.M. Chen and R.E. Peterson	Toxicol. Appl. Pharmacol. 83:402-411.
	1993	USEPA	EPA/600/R-93/055

If multiple values are available; selected value is bold and in italics.

Table 7-5
Comparison of Dead Creek Segment F Surface Water Concentrations to Criteria
Sauget Area I

Sample ID: **Compounds**[6]	SW-CSF-S1 **Concentration**	**ER Q**	SW-CSF-S2 **Concentration**	**ER Q**	SW-CSF-S3 **Concentration**	**ER Q**	Backround (Twice average of reference area)	Water Quality Benchmark Acute	Water Quality Benchmark Chronic
Herbicides (ug/l)	ND		ND		ND		ND		
Metals (mg/l)									
Aluminum	0.039	J	**0.15**	J	**0.55**		26	0.75 [2,c]	0.087 [2,c]
Arsenic	0.01	U	0.0032	J	0.0049	J	0.02	0.36 [1]	0.19 [1]
Barium	**0.13**		**0.13**		**0.12**		0.72	0.11 [3]	0.004 [3]
Copper	0.0016	J	0.002	J	0.012	J	0.02	0.044 [1,a]	0.027 [1,a]
Iron	0.5		0.55		1		32		1 [2]
Lead	0.005	U	0.0022	J	0.0037	J	0.06	0.33 [1,a]	0.069 [1,a]
Manganese	0.082	J	0.1	J	**0.14**	J	3.9	2.3 [3]	0.12 [3]
Molybdenum	0.01	U	0.01	U	0.0028	J	0.02	16 [3]	0.37 [3]
Nickel	0.0069	J	0.013	J	0.021	J	0.04	1.1 [2,b]	0.12 [2,b]
Zinc	0.0073	J	0.035		0.075		0.16	0.27 [2,b]	0.27 [2,b]
PCB (ug/l)	ND		ND		ND		ND		0.014 [2] [d]
Pesticides (ug/l)	ND		ND		ND				
SVOC (ug/l)									
Fluoranthene	0.7	J	10	U	10	U	ND		15 [4]
Dioxins (ug/l)								?	?
2,3,7,8-TCDD TEQ Mammal [5]	9.01197E-06		1.5012E-06		1.5583E-06		2.70E-05		

[1] Illinois Water Quality Standards

[2] US Environmental Protection Agency. 1999. National Recommended Water Quality Criteria—Correction. Office of Water, Washington, DC. April 1999. EPA 822-Z-99-001.

[3] Suter, GW, CL Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. Prepared for U.S. Department of Energy. Oak Ridge National Laboratory. June 1996. ES/ER/TM-96/R2.

[4] Suter, GW, CL Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. Prepared for U.S. Department of Energy. Oak Ridge National Laboratory. June 1996. ES/ER/TM-96/R2.

[5] Fish TEQ values were calculated for 2,3,7,8-TCDD

[6] Other COPCs were not detected in Dead Creek Sector F surface water

bolded values indicate exceedance of chronic Water Quality Benchmarks
shaded values indicate exceedance of acute Water Quality Benchmarks

"a" Calculated values for Illinois criteria are based on average hardness
"b" NAWQ Criteria for metals are calculated based on hardness
"c" At pH 6.5 - 9.0, see G, I, and L under National recommended water quality criteria for non priority pollutants
"d" For PCBs
Hardness dependent criteria calculated at a hardness of 220 mg/l as $CaCO_3$ (the lowest detected on site)

Table 7-6
Comparison of Borrow Pit Surface Water Concentrations to Criteria
Sauget Area I

Sample ID: / **Compounds**	SW-BPL-S1 **Concentration**	**ER Q**	SW-BPL-S2 **Concentration**	**ER Q**	SW-BPL-S3 **Concentration**	**ER Q**	Backropund (Twice average of reference area)	Water Quality Standards: Acute		Water Quality Standards: Chronic	
Herbicides (ug/l)	ND		ND		ND		ND				
Metals (mg/l)											
Aluminum	**3.4**		**0.71**		**0.65**		26	0.75	2,d	0.087	2,d
Arsenic	0.015		0.0079	J	0.012		0.02	0.36	1	0.19	1
Barium	**0.32**		**0.12**		**0.045**		0.72	0.11	3	0.004	3
Chromium	0.0041	J	0.01	U	0.01	U	0.04	4.036/.016	1,a	0.481/.011	1,a
Copper	0.0074	J	0.0036	J	0.0048	J	0.02	0.0468	1,a	0.0285	1,a
Iron	**8.7**	J	**1.6**	J	**1.3**	J	32			1	2
Lead	0.02		0.002	J	0.0029	J	0.06	0.355	1,a	0.0744	1,a
Manganese	**1.7**		**0.13**		**0.17**		3.9	2.3	3	0.12	3
Molybdenum	0.0035	J	0.01	U	0.004	J	0.02	16	3	0.37	3
Nickel	0.015	J	0.012	J	0.0077	J	0.04	1.1	2,b	0.12	2,b
Zinc	0.048		0.027		0.017	J	0.16	0.287	2,b	0.287	2,b
PCB (ug/l)	ND		ND		ND		ND			0.014	2,f
Pesticides (ug/l)											
delta-BHC	0.00013	J	0.0022	J	0.012	U	0.0125	39	3,g	2.2	3,g
Dieldrin	0.1	U	0.1	U	0.001	J	0.053	0.24	2	0.056	2
Endosulfan I	0.0024	J	0.05	U	0.0015	J	0.02	0.22	2,e	0.056	2,e
Endosulfan sulfate	0.1	U	0.1	U	0.0032	J	0.032	0.22	2,e	0.056	2,e
Endrin	0.1	U	0.1	U	0.00095	J	0.053	0.086	2,c	0.036	2,c
Endrin aldehyde	0.0032	J	0.1	U	0.0016	J	0.010	0.086	2,c	0.036	2,c
Endrin ketone	0.1	U	0.1	U	0.0027	J	0.060	0.086	2,c	0.036	2,c
gamma-BHC (Lindane)	0.019	U	0.0038	J	0.0024	J	0.013	0.95	2	0.036	2,c
Heptachlor	0.0026	J	0.0022	J	0.0029	J	0.039	0.52	2	0.0038	2
Heptachlor epoxide	0.00096	J	0.0009	J	0.05	U	0.012	0.52	2	0.0038	2
SVOC (ug/l)	ND		ND		ND						
Dioxins (ug/l?)											
2,3,7,8-TCDD TEQ Mammal [h]	8.5902E-07		7.453E-07		4.8413E-07		2.70E-05				

[1] Illinois Water Quality Standards

[2] US Environmental Protection Agency. 1999. National Recommended Water Quality Criteria—Correction. Office of Water, Washington, DC. April 1999. EPA 822-Z-99-001.

[3] Suter, GW, CL Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. Prepared for U.S. Department of Energy. Oak Ridge National Laboratory. June 1996. ES/ER/TM-96/R2.

bolded values indicate exceedance of chronic Water Quality Benchmarks
shaded values indicate exceedance of acute Water Quality Benchmarks

"a" Calculated values for Illinois criteria are based on average hardness
"b" NAWQ Criteria for metals are calculated based on hardness
"c" there is some uncertainty since the detection limit is greater than the AWQC
"d"At pH 6.5 - 9.0, see G, I, and L under National recommended water quality criteria for non priority pollutants
"e" For alpha- and beta-Endosulfan
"f" For PCBs
"g" For BHC (other)
"h" Mammal TEQ values were calculated for 2,3,7,8-TCDD
Hardness dependent criteria calculated at a hardness of 220 mg/l as $CaCO_3$ (the lowest detected on site)

Table 7-7
Comparison of Sediment Concentrations in Dead Creek Section F to Sediment Quality Guidelines
Sauget Area I

Sample ID: Compounds	SED-CSF-S1-0.2FT Concentration	ER Q	SED-CSF-S2-0.2FT Concentration	ER Q	SED-CSF-S3-0.2FT Concentration	ER Q	Background	Sediment Quality Guidelines[1] Consensus-based TEC	Sediment Quality Guidelines [1] Consensus-based PEC
Herbicides (ug/kg)									
2,4-D	110	UJ	240	UJ	23	J	20	NA	NA
Metals (mg/kg)									
Aluminum	7800	J	14000	J	17000	J	29000	NA	NA
Arsenic	8	J	**19**	J	15	J	14	9.79	33
Barium	150	J	250	J	270	J	410	NA	NA
Beryllium	0.53	J	0.85	J	0.89	J	1.6	NA	NA
Cadmium	**7.4**	J	**47**	J	**14**	J	0.83	0.99	4.98
Chromium	19	J	38	J	30	J	40	43.4	111
Copper	**160**	J	**410**	J	**240**	J	38	31.6	149
Iron	14000	J	**22000**	J	**26000**	J	42000	20000 [2]	40000 [2]
Lead	**110**	J	**320**	J	**110**	J	44	35.8	128
Manganese	170	J	230	J	**510**	J	1400	460 [2]	1100 [2]
Mercury	**0.3**	J	**1.1**	J	**0.45**	J	0.096	0.18	1.06
Molybdenum	0.7	J	3.7	J	0.76	J	0.89	NA	
Nickel	**90**	J	**390**	J	**180**	J	43	22.7	48.6
Zinc	**950**	J	**2700**	J	**1600**	J	170	121	459
PCBs and Pesticides (ug/kg)									
Total PCBs	**83**	J	**83**	J	120	UJ	15	59.8	676
4,4'-DDT	**4.5**	J	35	UJ	24	UJ	ND	4.16 [3]	62.9 [3]
Total DDT	**19**	J	**43**	J	**27**	J	ND	5.28	572
Aldrin	**4.1**	J	18	UJ	12	UJ	ND	2 [2]	320, 1120, 488 [2,5]
Alpha Chlordane	**4.6**	J	**5.3**	J	0.84	J	ND	3.24 [4]	17.6 [4]
delta-BHC	0.34	J	5.3	UJ	3.7	UJ	ND	NA	NA
Dieldrin	**9.3**	J	35	UJ	0.99	J	ND	1.9	61.8
Endosulfan I	5.7	J	2	J	1.2	J	ND	NA	NA
Endosulfan II	8.1	J	5.5	J	1.8	J	ND	NA	NA
Endosulfan sulfate	2.8	J	35	UJ	24	UJ	ND	NA	NA
Endrin	1.7	J	35	UJ	1.7	J	ND	2.22	207
Endrin aldehyde	14	J	9	J	3.6	J	ND	NA	NA
Endrin ketone	10	J	7.2	J	3.8	J	ND	NA	NA
Gamma Chlordane	**17**	J	**7.5**	J	2.4	J	ND	3.24 [4]	17.6 [4]
Heptachlor	7.8	UJ	18	UJ	**0.93**	J	ND	0.3 NEL [2]	NA
Heptachlor epoxide	**5.4**	J	18	UJ	0.51	J	ND	2.47	16
Methoxychlor	24	J	14	J	7.3	J	ND	NA	NA
SVOC (ug/kg)									
Fluoranthene	120	J	**890**	UJ	130	J	ND	423	2230
Dioxins (ug/kg)									
2,3,7,8-TCDD TEQ Mammal [6]	0.144391		0.3318165		0.170232		0.0125	NA	NA

Background = 2 x average concentration from reference areas.
NA indicates not available.
[1] MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Arch. Environ. Contam. Toxicol.* 3

[2] Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of Environment and Energy. August 1993.

[3] Guidelines for sum DDT
[4] Guidelines for Chlordane
[5] Ontario SEL value is site specific based on TOC value
[6] Mammal TEQ values were calculated for 2,3,7,8-TCDD
bolded numbers exceed TEC value, or Ontario LEL or NEL value
shaded numbers exceed PEC value

Table 7-8
Comparison of Borrow Pit Lake Sediment Concentrations to Sediment Quality Guidelines
Sauget Area I

Sample ID: / **Compounds**	BPL-ESED-S1-0.2FT Average **Concentration**	**ER Q**	BPL-ESED-S2-0.2FT **Concentration**	**ER Q**	BPL-ESED-S3-0.2FT **Concentration**	**ER Q**	**Background**	**Sediment Quality Guidelines [1] Consensus-based TEC**	**Sediment Quality Guidelines [1] Consensus-based PEC**
Herbicides (ug/kg)									
2,4-D	8.8	J	24	UJ	11	J	20	NA	NA
Metals (mg/kg)									
Aluminum	14000	J	16000	J	11000	J	29000	NA	NA
Arsenic	**17**	J	**17**	J	**13**	J	14	9.79	33
Barium	390	J	420	J	240	J	410	NA	NA
Beryllium	0.74	J	0.82	J	0.58	J	1 6	NA	NA
Cadmium	**2**	J	**2.7**	J	**1.6**	J	0.83	0.99	4.98
Chromium	21	J	26	J	18	J	40	43.4	111
Copper	46	U	**64**	J	**36**	J	38	31.6	149
Iron	36000	U	**38000**	J	**28000**	J	42000	20000 [2]	40000 [2]
Lead	52	U	**58**	J	34	J	44	35.8	128
Manganese	**1300**	J	**1400**	J	**940**	J	1400	460 [2]	1100 [2]
Mercury	0.1	U	0.16	J	0 11	J	0.096	0.18	1.06
Molybdenum	0.5	U	0.92	J	0.37	J	0.89		
Nickel	53	U	**54**	J	**35**	J	43	22.7	48 6
Silver	2.8	UJ	0.79	J	2.5	UJ	2.05		
Zinc	**310**	J	**370**	J	**250**	J		121	459
Pesticides (ug/kg)									
4,4'-DDE	1.1	J	**3.2**	J	1.6	J	ND	3.16 [3]	31.3 [3]
4,4'-DDT	1.1	J	19	UJ	1.4	J	ND	4.16 [3]	62 9 [3]
Total DDT	2.2	J	**22**	J	3	J	ND	5.28	572
Alpha Chlordane	0.48	J	3.2	J	1.2	J	ND	3.24 [4]	17.6 [4]
Dieldrin	0.26	J	0.5	J	18	UJ	ND	1.9	61.8
Endosulfan I	4.9	J	2 8	J	1	J	ND		
Endosulfan sulfate	9.5	J	1.4	J	18	UJ	ND		
Endrin aldehyde	1.4	J	2.2	J	1.2	J	ND		
Endrin ketone	0.72	J	19	UJ	18	UJ	ND		
Gamma Chlordane	0.74	J	3	J	9.4	UJ	ND	3.24 [4]	17.6 [4]
gamma-BHC (Lindane)	**4.8**	J	9.9	UJ	9.4	UJ	ND	2.37	4.99
Heptachlor epoxide	**4.8**	J	9.9	UJ	9.4	UJ	ND	2.47	16
Dioxins (ug/kg)									
2,3,7,8-TCDD TEQ Mammal [5]	0.0134195				0.0194186		0.0125		

Backround = 2 x average concentration from reference areas
[1] MacDonald, D D., C G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ Contamin. Toxicol. 39:20-31

[2] Persaud, D., R Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of Environment and Energy. August, 1993

[3] Guidelines for sum DDT
[4] Guidelines for Chlordane
[5] Mammal TEQ values were calculated for 2,3,7,8-TCDD
bolded numbers exceed TEC value or Ontario LEL value
shaded numbers exceed PEC value

Table 7-9
Number of Taxa, Number of Organisms, and Three Dominant Taxa In Dead Creek Section F and Borrow Pit Lake Samples
Sauget Area I

Location	Station	Number of Organisms	Number of Taxa	Dominant Taxon*	2nd Dominant Taxon	3rd Dominant Taxon	Total Organic Carbon, percent
Dead Creek Section F	F-1	156	16	Chironomidae	Sphaeriidae	Chironomidae	4.0
	F-2	154	11	Ceratopogonidae	Oligochaeta	Ceratopopogonidae	14
	F-3	358	17	Oligochaeta	Oligochaeta	Chironomidae	6.1
Borrow Pit Lake	BP-1	126	18	Oligochaeta	Odonata	Oligochaeta	6.7
	BP-2	262	17	Oligochaeta	Oligochaeta	Ceratopogonidae	4.5
	BP-3	151	14	Oligochaeta	Oligochaeta	Oligochaeta	3.3
Prairie du Pond Creek (Reference Area 1)	PDC-1	92	8	Oligochaeta	Ceratopogonidae	Oligochaeta	1.2
	PDC-2	148	9	Oligochaeta	Chaoboridae	Oligochaeta	2.3
Reference Area 2	REF2-1	4420	16	Oligochaeta	Ceratopogonidae	Chironomidae	1.3
	REF2-2	87	13	Oligochaeta	Ceratopogonidae	Chironomidae	2.0

*Dominant taxa were calculated at the genus or species level but expressed as higher taxa.

Table 7-10
Diversity Indices for Dead Creek Section F, the Borrow Pit Lake, and Reference Areas
Sauget Area I

Summation of Replicates	H' (Shannon-Weaver Index (natural log))[a]	Relative H' (H'/H'max)[b]	λ (Simpson's Index)[c]
F-1	2.28	0.82	0.14
F-2	1.66	0.69	0.25
F-3	1.60	0.56	0.31
BP-1	2.53	0.87	0.11
BP-2	2.09	0.74	0.23
BP-3	1.56	0.59	0.35
PDC-1	0.66	0.32	0.74
PDC-2	0.58	0.26	0.79
REF2-1	1.09	0.39	0.53
REF2-2	1.24	0.48	0.49

Notes:
a: Shannon-Weaver is an index which measures species diversity. The higher the number, the greater the species diversity.
b: Relative H' shows how close the sample is to maximum diversity, even distribution of organisms among the taxa is represented by "1".
c: Simpson's is an index which measures the probability of two randomly selected organisms from a sample belonging to the same taxon. It is indirectly proportional to heterogeneity (the higher the value, the more homogeneous the sample.

Table 7-11
Community Composition of Six Major Taxonomic Groups
Sauget Area I

Station	Taxa Group (6 Total)	Number of Organisms	Relative Abundance (%)
F-1	Chironomidae	74	47.44
F-1	Mollusca	34	21.79
F-1	Non-Chironomid Insects	26	16.67
F-1	Oligochaeta	22	14.10
F-2	Non-Chironomid Insects	96	62.34
F-2	Oligochaeta	44	28.57
F-2	Chironomidae	14	9.09
F-3	Oligochaeta	286	81.25
F-3	Chironomidae	36	10.23
F-3	Non-Chironomid Insects	24	6.82
F-3	Mollusca	6	1.70
BP-1	Non-Chironomid Insects	56	44.44
BP-1	Oligochaeta	48	38.10
BP-1	Chironomidae	12	9.52
BP-1	Other*	10	7.94
BP-2	Oligochaeta	178	67.94
BP-2	Chironomidae	54	20.61
BP-2	Non-Chironomid Insects	30	11.45
BP-3	Oligochaeta	122	80.79
BP-3	Non-Chironomid Insects	17	11.26
BP-3	Chironomidae	12	7.95
PDC-1	Oligochaeta	85	92.39
PDC-1	Non-Chironomid Insects	6	6.52
PDC-1	Chironomidae	1	1.09
PDC-2	Oligochaeta	138	93.24
PDC-2	Chironomidae	4	2.70
PDC-2	Non-Chironomid Insects	4	2.70
PDC-2	Crustacea	1	0.68
PDC-2	Mollusca	1	0.68
REF2-1	Oligochaeta	3210	72.62
REF2-1	Non-Chironomid Insects	820	18.55
REF2-1	Chironomidae	320	7.24
REF2-1	Mollusca	50	1.13
REF2-1	Crustacea	20	0.45
REF2-2	Oligochaeta	62	71.26
REF2-2	Chironomidae	14	16.09
REF2-2	Non-Chironomid Insects	11	12.64

*Hirudinea and Nematoda

Table 7-12
Hilsenhoff's Biotic Index of Organic Stream Pollution
Sauget Area I

Summation of Replicates	Hilsenhoff's Biotic Index (Expanded to Include Non-Arthropod Invertebrates)
BP-1	7.88
BP-2	8.86
BP-3	9.18
F-1	7.63
F-2	6.71
F-3	8.65
PDC-1	9.55
PDC-2	9.69
REF2-1	9.42
REF2-2	9.04
Value of Biotic Index	Degree of Impairment
0 - 3.5	None
3.51 - 4.5	Possible/Slight
4.51 - 5.5	Some
5.51 - 6.5	Fairly Significant
6.51 - 7.5	Significant
7.51 - 8.5	Very Significant
8.51 - 10.0	Severe

*Adapted from Hilsenhoff, 1987.

Table 7-13
***Hyalella azteca* Acute Toxicity Results**
Sauget Area I

***Results of 10 day Hyalella azteca* Acute Toxicity Tests**

Survival significantly lower than lab control *P<0.05

ID	Survival (%)	Growth (mg)
Lab Control	**86**	**0.223**
None from Section F or Borrow Pit Lake		

Growth Significantly lower than lab control P<0.05

ID	Survival (%)	Growth (mg)
Lab Control	**86**	**0.202**
Borrow Pit 1	89	0.156
Borrow Pit 1 Dup.	94	0.154
Borrow Pit 3	91	0.154

Survival and Growth NOT significantly lower than lab control

ID	Survival (%)	Growth (mg)
Lab Control	**86**	**0.202**
Creek Section F-1	91	0.221
Creek Section F-2	86	0.219
Creek Section F-3	83	0.183
Borrow Pit 2	96	0.172
Lab Control	**98**	**0.268**
PDC-1 (reference)	98	0.254
PDC-2 (reference)	98	0.404
Reference 2-1	98	0.393
Reference 2-2	98	0.335

Table 7-14
***Hyallela azteca* 42 Day Chronic Survival, Growth, And Reproduction Results**
Sauget Area I

	ID	Day 28 Mean Survival (%)	Day 28 Mean Dry Weight (mg)	Day 35 Mean Survival (%)	Day 42 Mean Survival (%)	Day 42 Mean Dry Weight (mg)	Day 42 Mean Number of Neonates/Female
Lotic, creek habitat	**PDC-1 (reference)**	**90**	**0.443**	**83**	**79**	**0.346**	**2.6**
	PDC-2 (reference)	**89**	**0.648**	**85**	**80**	**0.498**	**6.2**
	Creek Section F-1	91	0.639	89	84	0.397	4.8
	Creek Section F-2	90	0.554	74	70	0.447	3.8
	Creek Section F-3	89	0.661	85	76	0.406	4.8
	Ref-2-1 (creek portion)	70*		64	65	0.459	2.3
	*Statistically significant reduction in lentic sample response relative to reference samples PDC-1 and PDC-2; P<0.05						
Lentic, pond habitat	**Ref-2-2**	**87**	**0.458**	**85**	**83**	**0.351**	**3.4**
	Borrow Pit 1	93	0.594	88	83	0.380	4.1
	Borrow Pit 1 Dup.	89	0.636	80	75	0.423	4.2
	Borrow Pit 2	82	0.563	74	73	0.390	4.3
	Borrow Pit 3	95	0.470	86	84	0.322	5.3
	No lentic samples exhibited statistically significant reductions in response compared to Ref-2-2.						
Laboratory Controls	12552	55	0.982	51	46	0.231	0.6
	12615	62	0.296	36	33	0.299	1.8
	12622	55	0.501	38	35	0.377	4.0
	12668	73	0.477	65	59	0.293	2.2

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Table 7-15
Acute Sediment Toxicity Testing Results with *Chironomus tentans*
Sauget Area I

***Chironomus tentans* Acute Toxicity Results (Day 10)**

Survival significantly lower than lab control P<0.05

ID	Survival (%)	Growth (mg)	Interpretation
Lab Control	**94**	**1.761**	
Borrow Pit 1	64	2.643	
Borrow Pit 1 Dup.	40	4.071	
Borrow Pit 2	14	0.956	Acute toxicity
Borrow Pit 3	53	2.996	
Creek Section F-1	31	2.686	Acute toxicity
Creek Section F-2	16	0.053*	Acute toxicity
Creek Section F-3	10	0.969	Acute toxicity
Lab Control	**100**	**2.065**	
PDC-1 (reference)	16	1.052*	Acute toxicity
PDC-2 (reference)	55	2.699	
Reference 2-1	13	0.346*	Acute toxicity
Reference 2-2	11	1.409	Acute toxicity

* Significant difference in growth.

Table 7-16
Results of *Chironomus tentans* Chronic Survival, Growth, Emergence, and Reproduction Toxicity Tests
Sauget Area I

	ID	Day 20 Mean Survival (%)	Day 20 Mean Ash Weight (mg)	Emergence Proportion (%)	Mean Eggs Hatched/ Female	Mean Days Survived, Female	Mean Days Survived, Male
Lab Control	**12622**	**46**	**2.959**	**45**	**554**	**3.1**	**4.9**
	Borrow Pit 1	0*		5*	0*	0*	0.7*
	Borrow Pit 1 Dup.	0*		8*	127*	0.3*	0.8*
	Borrow Pit 3	6*		14*	106*	0.8*	1.2*
Lab Control	**12668**	**65**	**2.923**	**69**	**354**	**3.6**	**4.3**
	PDC-2 (reference)	*69*	*3.074*	*13**	*249*	*1.1**	*1.4**

*Significantly different from corresponding laboratory control; P<0.05

Note: Samples exhibiting acute toxicity were not tested for chronic toxicity.

Table 7-17
List of Fish and Wildlife Species Observed On and Near Dead Creek and the Borrow Pit Lake
Sauget Area I

		Dead Creek Floodplain			Dead Creek and Borrow Pit Lake		
Common Name	Scientific Name	Wet/ Upland Shrubs	Wet/Dry Field	Riparian Woods	Dead & Prairie du Pont Creeks	Borrow Pit Lake	Mississippi River
AMPHIBIANS							
American Toad	*Bufo americanus*	O	X	X	X	X	
Gray Treefrog	*Hyla versicolor*	X		O	X	X	
Pickerel Frog	*Rana palustris*	X	O	X	X	X	
REPTILES							
Red-eared Slider	*Pseudemys scripta*				O		X
Painted Turtle	*Chrysemys picta*				O	O	X
BIRDS							
Great Blue Heron	*Ardea herodias*		X	O	O	X	O
Great Egret	*Casmerodius albus*		O		O	O	O
Snowy Egret	*Egretta caerulea*				O	O	O
Little Blue Heron	*Egretta thula*				O	O	O
Cattle Egret	*Bubulcus ibis*		O				
Green-backed Heron	*Butorides striatus*	O		X	O	O	O
Black-crowned Night-Heron	*Nycticorax nycticorax*			X	O	X	O
Wood Duck	*Aix sponsa*	X		X	O	X	X
Mallard	*Anas platyrhynchos*	X	X	X	O	X	X
Turkey Vulture	*Cathartes aura*	X	O	X		X	
Bald Eagle	*Haliaeetus leucocephalus*			old nest	X		X
Red-tailed Hawk	*Buteo jamaicensis*	X	O	O			
American Kestrel	*Falco sparverius*	O	O				
Nothern Bobwhite	*Colinus virginianus*	O	X				
Killdeer	*Charadrius vociferus*		O				
Rock Dove	*Columba livia*		X				
Mourning Dove	*Zenaida macroura*	O	O	O			
Yellow-billed Cuckoo	*Coccyzus americanus*	O		O			
Chimney Swift	*Chaetura pelagica*	O	X	X	O	O	X
Belted Kingfisher	*Ceryle alcyon*				O	O	O
Red-headed Woodpecker	*Melanerpes erythrocephalus*			O			

Table 7-17
List of Fish and Wildlife Species Observed On and Near Dead Creek and the Borrow Pit Lake
Sauget Area I

Common Name	Scientific Name	Dead Creek Floodplain: Wet/ Upland Shrubs	Dead Creek Floodplain: Wet/Dry Field	Dead Creek Floodplain: Riparian Woods	Dead Creek and Borrow Pit Lake: Dead & Prairie du Pont Creeks	Dead Creek and Borrow Pit Lake: Borrow Pit Lake	Dead Creek and Borrow Pit Lake: Mississippi River
Downy Woodpecker	*Picoides pubescens*	O		O			
Eastern Phoebe	*Sayornis phoebe*	X		O	O	X	X
Eastern Kingbird	*Tyrannus tyrannus*	O	O		X	X	X
Tree Swallow	*Tachycineta bicolor*	X	O	X	O	X	X
Bank Swallow	*Riparia riparia*	X	O	X	X	X	X
Cliff Swallow	*Hirundo pyrrhonota*	X	O	X	X	X	X
Barn Swallow	*Hirundo rustica*	X	O	X	O	O	X
Blue Jay	*Cyanocitta cristata*	X		O			
American Crow	*Corvus brachyrhynchos*	X	O	O			
Carolina Chickadee	*Parus carolinensis*	X		O			
Tufted Titmouse	*Parus bicolor*			O			
White-breasted Nuthatch	*Sitta carolinensis*			O			
Brown Creeper	*Certhia americana*			O			
Carolina Wren	*Thryothorus ludovicianus*	O		X			
House Wren	*Troglodytes aedon*	O		O			
American Robin	*Turdus migratorius*	O	O	O			
Gray Catbird	*Dumetella carolinensis*	O		O			
Nothern Mockingbird	*Mimus polyglottos*	X	X				
Cedar Waxwing	*Bombycilla cedrorum*	O		O			
European Starling	*Sturnus vulgaris*	X	O	O			
Common Yellowthroat	*Geothylpis trichas*	O		X			
Northern Cardinal	*Cardinalis cardinalis*	O		O			
Indigo Bunting	*Passerina cyanea*	O		O			
Song Sparrow	*Melospiza melodia*	O	O	X			
Red-winged Blackbird	*Agelaius phoeniceus*	O	O	O	O	O	
Common Grackle	*Quiscalus quiscula*	O	X	O			
Northern Oriole	*Icterus galbula*			O			
American Goldfinch	*Carduelis tristis*	O	O	O			
House Sparrow	*Passer domesticus*		X				
MAMMALS							
Gray Squirrel	*Sciurus carolinensis*	O		O			
Fox Squirrel	*Sciurus niger*			O			
Beaver	*Castor canadensis*			O	O	O	O

Table 7-17
List of Fish and Wildlife Species Observed On and Near Dead Creek and the Borrow Pit Lake
Sauget Area I

Common Name	Scientific Name	Dead Creek Floodplain Wet/ Upland Shrubs	Wet/Dry Field	Riparian Woods	Dead Creek and Borrow Pit Lake Dead & Prairie du Pont Creeks	Borrow Pit Lake	Mississippi River
Raccoon	*Procyon lotor*	O	X	O	O	O	O
White-tailed Deer	*Odocoileus virginianus*	O	O	O	O		
FISH*							
Bowfin	*Amia calva*				SO	O	
Gizzard Shad	*Dorosoma cepedianum*				SO		
Grass Pickeral	*Esox americanus*				SO		
Common Stoneroller	*Campostoma anomalum*				SO		
Goldfish	*Carassius auratus*				SO		
Carp	*Cyprinus carpio*				SO	O	
Golden Shiner	*Notemigonus crysoleucas*				SO		
Bigmouth Shiner	*Notropis dorsalis*				SO		
Red Shiner	*Notropis lutrensis*				SO		
Sand Shiner	*Notropis stramineus*				SO		
Fathead Minnow	*Pimephales promelas*				SO		
Creek Chub	*Semotilus atromaculatus*				SO		
White Sucker	*Catastomus commersoni*				SO		
Bigmouth Buffalo	*Ictiobus cyprinellus*				SO		
Black Bullhead	*Ictalurus melas*				SO		
Yellow Bullhead	*Ictalurus natalis*				SO	O	
Channel Catfish	*Ictalurus punctatus*				O & SO		
Mosquitofish	*Gambusia affinis*				SO		
Green Sunfish	*Lepomis cyanellus*				SO		
Warmouth	*Lepomis gulosus*				SO		
Orangespotted Sunfish	*Lepomis humilis*				SO		
Bluegill	*Lepomis macrochirus*				SO	O	
Largemouth Bass	*Micropterus salmoides*				SO	O	
Black Crappie	*Pomoxis nigromaculatus*				SO	O	
Freshwater Drum	*Aplodinotus grunniens*				SO	O	
White Bass	*Morone chrysops*					O	
Crappie	*Pomoxis spp.*					O	
White Crappie	*Pomoxis annularis*					O	
Brown Bullhead	*Ameiurus nebulosus*					O	
Black Bullhead	*Ameiurus melas*					O	
Gar	*Lepisosteus spp.*					O	

Table 7-17
List of Fish and Wildlife Species Observed On and Near Dead Creek and the Borrow Pit Lake
Sauget Area I

		Dead Creek Floodplain			Dead Creek and Borrow Pit Lake		
Common Name	**Scientific Name**	**Wet/ Upland Shrubs**	**Wet/Dry Field**	**Riparian Woods**	**Dead & Prairie du Pont Creeks**	**Borrow Pit Lake**	**Mississippi River**
Spotted Gar	*Lepisosteus oculatus*					O	
Johnny Darter	*Etheostoma nigrum*					O	
Silver Carp	*Hypophthalmichthys molitrix*					O	
Quillback	*Carpiodes cyprinus*					O	
Moon eye	*Hiodon tergisus*					O	
Gold eye	*Hiodon alosoides*					O	
Walleye	*Stizostedion vitreum*					O	
Small unidentified fish					O	O	O

X - Species Probably Utilizes Habitat O - Species Observed in the Habitat

SO - Species Observed in the Prairie du Pont drainage during 1984 State Stream Survey

* From Atwood, E.R., 1992. Assessment of Fisheries Quality of Streams in the American Bottoms Basin, IL Dept. of Conservation, 48 pp.

Table 7-18
Comparison of Plant Concentrations Between Dead Creek Section F and both Reference Areas
Sauget Area I

Compound	Site Maximum	Site Average	Reference Maximum	Reference Average
Herbicides (ug/kg)				
2,4-D	ND	ND	ND	ND
Dicamba	ND	ND	1.8	5.9
Dichloroprop	**7**	**28.5**	**ND**	**ND**
MCPA	ND	ND	ND	ND
MCPP	ND	ND	1300	1150
Metals (mg/kg)				
Aluminum, Total	44	37	360	260
Antimony	**0.13**	**0.115**	**ND**	**ND**
Arsenic, Total	0.56	0.49	1.1	0.78
Barium, Total	ND	ND	ND	ND
Cadmium, Total	**0.097**	**0.1735**	**ND**	**ND**
Chromium, Total	ND	ND	0.53	0.39
Copper, Total	**2.1**	**2**	**1.3**	**1.13**
Iron	ND	ND	ND	ND
Lead, Total	**1.2**	**0.82**	**0.64**	**0.47**
Manganese	ND	ND	ND	ND
Mercury	ND	ND	ND	ND
Molybdenum	ND	ND	ND	ND
Nickel, Total	**2.6**	**1.9**	**ND**	**ND**
Silver	ND	ND	ND	ND
Zinc, Total	**26**	**23**	**8.3**	**7.55**
Total PCBs (ug/kg)	ND	ND	ND	ND
Pesticides (ug/kg)				
4,4'-DDD	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND
Aldrin	0.81	3.905	1	4
Alpha Chlordane	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Gamma Chlordane	**3.1**	**5.05**	**ND**	**ND**
gamma-BHC (Lindane)	ND	ND	ND	ND
Heptachlor	1.9	1.85	3.8	5.4
Heptachlor epoxide	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
SVOC (ug/kg)				
bis(2-ethylhexyl)phthalate	ND	ND	ND	ND
Di-n-butylphthalate	ND	ND	ND	ND
Diethylphthalate	ND	ND	ND	ND
Acenaphthylene	**32**	**58.5**	**ND**	**ND**
Fluoranthene	ND	ND	ND	ND
Benzo(b)fluoranthene	**59**	**72**	**16**	**51**
Benzo(k)fluoranthene	**52**	**68.5**	**21**	**53**
Benzo(a)pyrene	**140**	**140**	**37**	**26**
Benzo(a)pyrene	ND	ND	ND	ND
Indeno(1,2,3-c-d)pyrene	300	192.5	440	330
Dibenz(a,h)anthracene	76	80.5	400	290
2,3,7,8-TCDD TEQ Mammal	0.000202	0.00017	8.46E-05	5.75E-05
2,3,7,8-TCDD TEQ Bird	9.73E-05	8.48E-05	2.97E-05	2.06E-05

Table 7-19
Results of Food Chain Modeling
Sauget Area I

	SCENARIO							
	Mallard Duck-- Creek Sector F Plant Ingestion-- Average		Mallard Duck-- Creek Sector F Plant Ingestion-- Maximum		Female Muskrat-- Creek Sector F Plant Ingestion--Average		Female Muskrat-- Creek Sector F Plant Ingestion--Maximum	
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index
2,4-D	NB	NB	NB	NB	6.E-05	1.E-05	6.E-05	2.E-05
Dicamba	NB	NB	NB	NB	0.E+00	0.E+00	0.E+00	0.E+00
Dichloroprop	NB	NB	NB	NB	NB	NB	NB	NB
MCPA	NB	NB	NB	NB	0.E+00	0.E+00	0.E+00	0.E+00
MCPP	NB	NB	NB	NB	0.E+00	0.E+00	0.E+00	0.E+00
Aluminum, Total	1.E-04	NB	4.E-01	NB	**5.E+01**	**5.E+00**	**7.E+01**	**7.E+00**
Antimony	NB	NB	NB	NB	9.E-01	9.E-02	1.E+00	1.E-01
Arsenic, Total	2.E-05	7.E-06	4.E-02	2.E-02	1.E-01	NB	1.E-01	NB
Barium, Total	9.E-06	4.E-06	2.E-02	1.E-02	5.E-02	4.E-02	6.E-02	4.E-02
Cadmium, Total	2.E-05	2.E-06	7.E-02	5.E-03	1.E-01	1.E-02	2.E-01	2.E-02
Chromium, Total	2.E-05	5.E-06	6.E-02	1.E-02	3.E-05	NB	4.E-05	NB
Copper, Total	1.E-05	8.E-06	3.E-02	2.E-02	1.E-01	9.E-02	1.E-01	1.E-01
Iron	NB	NB	NB	NB	NB	NB	NB	NB
Lead, Total	2.E-04	2.E-05	8.E-01	8.E-02	1.E-01	1.E-02	2.E-01	2.E-02
Manganese	3.E-07	NB	8.E-04	NB	1.E-02	3.E-03	2.E-02	6.E-03
Mercury	8.E-05	8.E-06	3.E-01	3.E-02	5.E-02	1.E-02	1.E-01	2.E-02
Molybdenum	4.E-07	4.E-08	2.E-03	2.E-04	6.E-02	6.E-03	1.E-01	1.E-02
Nickel, Total	6.E-06	4.E-06	2.E-02	1.E-02	4.E-02	2.E-02	6.E-02	3.E-02
Silver	NB	NB	NB	NB	0.E+00	0.E+00	0.E+00	0.E+00
Zinc, Total	4.E-04	4.E-05	1	1.E-01	1.E-01	5.E-02	1.E-01	7.E-02
Total PCBs	3.E-07	3.E-08	1.E-03	1.E-04	1.E-03	6.E-04	2.E-03	9.E-04
Total DDT	9.E-06	9.E-07	2.E-02	2.E-03	1.E-04	2.E-05	1.E-04	3.E-05
Aldrin	NB	NB	NB	NB	2.E-03	4.E-04	2.E-03	4.E-04
Alpha Chlordane	1.E-09	3.E-10	4.E-06	8.E-07	4.E-06	2.E-06	6.E-06	3.E-06
delta-BHC	5.E-10	1.E-10	1.E-06	2.E-07	5.E-05	5.E-06	5.E-05	5.E-06
Dieldrin	1.E-07	NB	2.E-04	NB	1.E-03	1.E-04	1.E-03	1.E-04
Endosulfan I	2.E-10	NB	9.E-07	NB	5.E-05	NB	1.E-04	NB
Endosulfan II	4.E-10	NB	1.E-06	NB	9.E-05	NB	1.E-04	NB
Endosulfan sulfate	2.E-10	NB	4.E-07	NB	5.E-05	NB	5.E-05	NB
Endrin aldehyde	7.E-07	7.E-08	2.E-03	2.E-04	5.E-04	5.E-05	8.E-04	8.E-05
Endrin ketone	6.E-07	6.E-08	2.E-03	2.E-04	4.E-04	4.E-05	6.E-04	6.E-05
Gamma Chlordane	2.E-07	4.E-08	4.E-04	9.E-05	6.E-04	3.E-04	6.E-04	3.E-04
gamma-BHC (Lindane	0.E+00	0.E+00	0	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
Heptachlor	NB	NB	NB	NB	7.E-03	7.E-04	7.E-03	7.E-04
Heptachlor epoxide	NB	NB	NB	NB	1.E-04	1.E-05	1.E-04	1.E-05
Methoxychlor	NB	NB	NB	NB	1.E-05	5.E-06	2.E-05	8.E-06
Total PAHs	2.E-06	2.E-07	0.004956	5.E-04	*	*	*	*
bis(2-ethylhexyl)phthal	0	NB	0	NB	0.E+00	0.E+00	0.E+00	0.E+00
Di-n-butylphthalate	0	0	0	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
Diethylphthalate	NB	NB	NB	NB	0.E+00	NB	0.E+00	NB
Acenaphthylene	*	*	*	*	NB	NB	NB	NB
Fluoranthene	*	*	*	*	5.E-06	NB	5.E-06	NB
Benzo(b)fluoranthene	*	*	*	*	NB	NB	NB	NB
Benzo(k)fluoranthene	*	*	*	*	NB	NB	NB	NB
Benzo(a)pyrene	*	*	*	*	1.E-01	1.E-02	1.E-01	1.E-02
Indeno(1,2,3-c-d)pyrer	*	*			NB	NB	NB	NB
Dibenz(a,h)anthracene	*	*			NB	NB	NB	NB
Dioxin - TEQ	1.E-05	1.E-06	3.E-02	3.E-03	7.E-01	7.E-02	1.E+00	1.E-01

Table 7-19
Results of Food Chain Modeling
Saugat Area I

	SCENARIO									
	River Otter-- Borrow Pit Fish Ingestion-- Average		River Otter-- Borrow Pit Fish Ingestion-Maximum		Great Blue Heron-- Borrow Pit Fish Ingestion-Average		Great Blue Heron-- Borrow Pit Fish Average**		Great Blue Heron-- Borrow Pit Fish Ingestion-Maximum	
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index
2,4-D	9.E-08	2.E-08	9.E-06	2.E-06	NB	NB	NB	NB	NB	NB
Dicamba	3.E-05	9.E-06	1.E-03	3.E-04	NB	NB	NB	NB	NB	NB
Dichloroprop	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
MCPA	5.E-04	2.E-04	6.E-02	2.E-02	NB	NB	NB	NB	NB	NB
MCPP	8.E-06	3.E-06	0.E+00	0.E+00	NB	NB	NB	NB	NB	NB
Aluminum, Total	2.E-01	2.E-02	**2.E+01**	**2.E+00**	4.E-02	NB	0.00	NB	8.E-02	NB
Antimony	3.E-04	3.E-05	3.E-02	3.E-03	NB	NB	NB	NB	NB	NB
Arsenic, Total	6.E-05	NB	7.E-03	NB	8.E-05	3.E-05	5.E-08	2.E-08	1.E-04	5.E-05
Barium, Total	2.E-04	2.E-04	3.E-02	2.E-02	3.E-04	1.E-04	2.E-07	9.E-08	7.E-04	3.E-04
Cadmium, Total	2.E-05	2.E-06	2.E-03	2.E-04	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
Chromium, Total	4.E-07	NB	7.E-05	NB	5.E-02	1.E-02	3.E-05	7.E-06	9.E-02	2.E-02
Copper, Total	1.E-04	1.E-04	2.E-02	2.E-02	3.E-03	2.E-03	2.E-06	1.E-06	6.E-03	4.E-03
Iron	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
Lead, Total	1.E-04	1.E-05	2.E-02	2.E-03	4.E-02	4.E-03	3.E-05	3.E-06	8.E-02	8.E-03
Manganese	1.E-04	4.E-05	2.E-02	5.E-03	2.E-05	NB	2.E-08	NB	8.E-05	NB
Mercury	9.E-03	2.E-03	**2.E+00**	5.E-01	**4.E+00**	4.E-01	3.E-03	3.E-04	**1.E+01**	**1.E+00**
Molybdenum	8.E-05	8.E-06	1.E-02	1.E-03	4.E-05	4.E-06	3.E-08	3.E-09	5.E-05	5.E-06
Nickel, Total	1.E-05	5.E-06	1.E-03	6.E-04	5.E-06	4.E-06	3.E-09	2.E-09	9.E-06	6.E-06
Silver	4.E-07	4.E-08	3.E-05	3.E-06	NB	NB	NB	NB	NB	NB
Zinc, Total	3.E-04	2.E-04	4.E-02	2.E-02	2.E-01	3.E-02	2.E-04	2.E-05	4.E-01	4.E-02
Total PCBs	1.E-03	7.E-04	3.E-01	1.E-01	5.E-02	5.E-03	3.E-05	3.E-06	1.E-01	1.E-02
Total DDT	4.E-05	7.E-06	6.E-03	1.E-03	5.E-01	5.E-02	3.E-04	3.E-05	1.E+00	1.E-01
Aldrin	2.E-07	4.E-08	0.E+00	0.E+00	NB	NB	NB	NB	NB	NB
Alpha Chlordane	3.E-06	2.E-06	7.E-04	4.E-04	9.E-05	2.E-05	6.E-08	1.E-08	3.E-04	5.E-05
delta-BHC	8.E-07	8.E-08	2.E-05	2.E-06	1.E-07	3.E-08	9.E-11	2.E-11	2.E-07	4.E-08
Dieldrin	2.E-06	2.E-07	3.E-05	3.E-06	4.E-07	NB	3.E-10	NB	6.E-07	NB
Endosulfan I	2.E-07	NB	3.E-05	NB	8.E-09	NB	5.E-12	NB	1.E-08	NB
Endosulfan II	5.E-07	NB	0.E+00	NB	0.E+00	NB	0.E+00	NB	0.E+00	NB
Endosulfan sulfate	4.E-07	NB	6.E-05	NB	1.E-08	NB	7.E-12	NB	1.E-08	NB
Endrin aldehyde	4.E-07	4.E-08	5.E-05	5.E-06	1.E-05	1.E-06	7.E-09	7.E-10	1.E-05	1.E-06
Endrin ketone	1.E-06	1.E-07	2.E-05	2.E-06	9.E-06	9.E-07	6.E-09	6.E-10	1.E-05	1.E-06
Gamma Chlordane	6.E-06	3.E-06	1.E-03	6.E-04	2.E-04	3.E-05	1.E-07	2.E-08	4.E-04	9.E-05
gamma-BHC (Lindane	6.E-09	6.E-10	6.E-07	6.E-08	6.E-08	6.E-09	4.E-11	4.E-12	9.E-08	9.E-09
Heptachlor	3.E-05	3.E-06	3.E-03	3.E-04	NB	NB	NB	NB	NB	NB
Heptachlor epoxide	3.E-07	3.E-08	3.E-05	3.E-06	NB	NB	NB	NB	NB	NB
Methoxychlor	9.E-08	5.E-08	0.E+00	0.E+00	NB	NB	NB	NB	NB	NB
Total PAHs	*	*	*	*	3.E-04	3.E-05	2.E-07	2.E-08	3.E-04	3.E-05
bis(2-ethylhexyl)phthal	3.E-05	3.E-06	3.E-03	3.E-04	2.E-02	NB	1.E-05	NB	3.E-02	NB
Di-n-butylphthalate	2.E-07	5.E-08	2.E-05	5.E-06	1.E-02	1.E-03	7.E-06	7.E-07	1.E-02	1.E-03
Diethylphthalate	2.E-08	NB	2.E-06	NB	NB	NB	NB	NB	NB	NB
Acenaphthylene	NB	NB	NB	NB	*	*	4.3E-05	4.3E-06	*	*
Fluoranthene	8.E-09	NB	0.E+00	NB	*	*			*	*
Benzo(b)fluoranthene	NB	NB	NB	NB	*	*			*	*
Benzo(k)fluoranthene	NB	NB	NB	NB	*	*			*	*
Benzo(a)pyrene	2.E-06	2.E-07	0.E+00	0.E+00	*	*			*	*
Indeno(1,2,3-c-d)pyrer	NB	NB	NB	NB	*	*			*	*
Dibenz(a,h)anthracene	NB	NB	NB	NB	*	*			*	*
Dioxin - TEQ	5.E-03	5.E-04	8.E-01	8.E-02	6.E-02	6.E-03			1.E-01	1.E-02

Table 7-19
Results of Food Chain Modeling
Sauget Area I

	SCENARIO							
	Female Muskrat--Borrow Pit Clam Ingestion-Average		Female Muskrat--Borrow Pit Clam Ingestion-Maximum		River Otter--Borrow Pit Clam Ingestion--Average		River Otter--Borrow Pit Clam Ingestion-Maximum	
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index
2,4-D	3.E-05	6.E-06	3.E-05	6.E-06	9.E-08	2.E-08	9.E-06	2.E-06
Dicamba	2.E-04	6.E-05	0.E+00	0.E+00	6.E-07	2.E-07	0.E+00	0.E+00
Dichloroprop	NB	NB	NB	NB	NB	NB	NB	NB
MCPA	1.E-03	4.E-04	0.E+00	0.E+00	3.E-06	1.E-06	0.E+00	0.E+00
MCPP	6.E-01	2.E-01	6.E-01	2.E-01	3.E-03	1.E-03	3.E-01	1.E-01
Aluminum, Total	**4.E+01**	**4.E+00**	**5.E+01**	**5.E+00**	1.E-01	1.E-02	**2.E+01**	2.E+00
Antimony	9.E-02	9.E-03	9.E-02	9.E-03	3.E-04	3.E-05	3.E-02	3.E-03
Arsenic, Total	2.E-01	NB	2.E-01	NB	9.E-04	NB	9.E-02	NB
Barium, Total	8.E-02	6.E-02	1.E-01	8.E-02	2.E-04	2.E-04	3.E-02	2.E-02
Cadmium, Total	6.E-02	6.E-03	7.E-02	7.E-03	3.E-04	3.E-05	3.E-02	3.E-03
Chromium, Total	1.E-04	NB	2.E-04	NB	6.E-07	NB	9.E-05	NB
Copper, Total	4.E-02	3.E-02	4.E-02	3.E-02	1.E-04	1.E-04	2.E-02	1.E-02
Iron	NB	NB	NB	NB	NB	NB	NB	NB
Lead, Total	3.E-02	3.E-03	4.E-02	4.E-03	1.E-04	1.E-05	1.E-02	1.E-03
Manganese	5.E-02	1.E-02	7.E-02	2.E-02	1.E-04	4.E-05	2.E-02	5.E-03
Mercury	1.E-02	2.E-03	1.E-02	3.E-03	3.E-05	7.E-06	4.E-03	9.E-04
Molybdenum	5.E-02	5.E-03	6.E-02	6.E-03	8.E-05	8.E-06	1.E-02	1.E-03
Nickel, Total	4.E-03	2.E-03	4.E-03	2.E-03	1.E-05	5.E-06	1.E-03	6.E-04
Silver	5.E-04	5.E-05	4.E-04	4.E-05	2.E-06	2.E-07	2.E-04	2.E-05
Zinc, Total	5.E-02	2.E-02	7.E-02	4.E-02	2.E-04	1.E-04	3.E-02	2.E-02
Total PCBs	2.E-04	1.E-04	0.E+00	0.E+00	8.E-07	4.E-07	0.E+00	0.E+00
Total DDT	3.E-05	6.E-06	7.E-05	1.E-05	1.E-07	2.E-08	2.E-05	4.E-06
Aldrin	6.E-05	1.E-05	0.E+00	0.E+00	2.E-07	4.E-08	0.E+00	0.E+00
Alpha Chlordane	2.E-06	9.E-07	4.E-06	2.E-06	5.E-09	3.E-09	1.E-06	6.E-07
delta-BHC	4.E-04	4.E-05	2.E-04	2.E-05	8.E-07	8.E-08	2.E-05	2.E-06
Dieldrin	5.E-04	5.E-05	1.E-04	1.E-05	2.E-06	2.E-07	3.E-05	3.E-06
Endosulfan I	7.E-05	NB	1.E-04	NB	2.E-07	NB	3.E-05	NB
Endosulfan II	2.E-04	NB	0.E+00	NB	5.E-07	NB	0.E+00	NB
Endosulfan sulfate	1.E-04	NB	2.E-04	NB	4.E-07	NB	6.E-05	NB
Endrin aldehyde	2.E-04	2.E-05	2.E-04	2.E-05	4.E-07	4.E-08	5.E-05	5.E-06
Endrin ketone	4.E-04	4.E-05	1.E-04	1.E-05	1.E-06	1.E-07	2.E-05	2.E-06
Gamma Chlordane	3.E-06	2.E-06	3.E-06	2.E-06	9.E-09	5.E-09	1.E-06	5.E-07
gamma-BHC (Lindane	2.E-06	2.E-07	2.E-06	2.E-07	6.E-09	6.E-10	6.E-07	6.E-08
Heptachlor	8.E-03	8.E-04	8.E-03	8.E-04	4.E-05	4.E-06	4.E-03	4.E-04
Heptachlor epoxide	1.E-04	1.E-05	1.E-04	1.E-05	3.E-07	3.E-08	3.E-05	3.E-06
Methoxychlor	7.E-04	3.E-04	6.E-04	3.E-04	3.E-06	2.E-06	3.E-04	1.E-04
Total PAHs	*	*	*	*	*	*	*	*
bis(2-ethylhexyl)phthal	5.E-03	5.E-04	8.E-03	8.E-04	2.E-05	2.E-06	4.E-03	4.E-04
Di-n-butylphthalate	2.E-06	7.E-07	0.E+00	0.E+00	2.E-05	2.E-06	0.E+00	0.E+00
Diethylphthalate	1.E-05	NB	2.E-05	NB	7.E-09	2.E-09	1.E-05	NB
Acenaphthylene	NB	NB	NB	NB	NB	NB	NB	NB
Fluoranthene	2.E-06	NB	0.E+00	NB	8.E-09	NB	0.E+00	NB
Benzo(b)fluoranthene	NB	NB	NB	NB	NB	NB	NB	NB
Benzo(k)fluoranthene	NB	NB	NB	NB	NB	NB	NB	NB
Benzo(a)pyrene	6.E-04	6.E-05	0.E+00	0.E+00	2.E-06	2.E-07	0.E+00	0.E+00
Indeno(1,2,3-c-d)pyrer	NB	NB	NB	NB	NB	NB	NB	NB
Dibenz(a,h)anthracene	NB	NB	NB	NB	NB	NB	NB	NB
Dioxin - TEQ	1.E-01	1.E-02	2.E-01	2.E-02	4.E-04	4.E-05	6.E-02	6.E-03

Table 7-19
Results of Food Chain Modeling
Sauget Area I

	SCENARIO							
	Mallard Duck-- Borrow Pit Shrimp Ingestion-Average		Mallad Duck-- Borrow Pit Shrimp Ingestion-Maximum		Bald Eagle-- Borrow Pit Fish Ingestion-Average		Bald Eagle-- Borrow Pit Fish Ingestion-- Maximum	
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Hazard Index	LOAEL Hazard Index
2,4-D	NB	NB	NB	NB	NB	NB	NB	NB
Dicamba	NB	NB	NB	NB	NB	NB	NB	NB
Dichloroprop	NB	NB	NB	NB	NB	NB	NB	NB
MCPA	NB	NB	NB	NB	NB	NB	NB	NB
MCPP	NB	NB	NB	NB	NB	NB	NB	NB
Aluminum, Total	2.E-03	NB	3.E-01	NB	3.E-05	NB	4.E-02	NB
Antimony	NB	NB	NB	NB	NB	NB	NB	NB
Arsenic, Total	4.E-05	2.E-05	5.E-03	2.E-03	1.E-07	5.E-08	1.E-04	4.E-05
Barium, Total	2.E-04	1.E-04	3.E-02	2.E-02	4.E-07	2.E-07	6.E-04	3.E-04
Cadmium, Total	2.E-05	1.E-06	3.E-03	2.E-04	0.E+00	0.E+00	0.E+00	0.E+00
Chromium, Total	1.E-03	2.E-04	1.E-01	3.E-02	1.E-04	2.E-05	1.E-01	2.E-02
Copper, Total	6.E-04	4.E-04	7.E-02	6.E-02	3.E-06	2.E-06	2.E-03	2.E-03
Iron	NB	NB	NB	NB	NB	NB	NB	NB
Lead, Total	2.E-03	2.E-04	2.E-01	2.E-02	4.E-05	4.E-06	3.E-02	3.E-03
Manganese	2.E-05	NB	2.E-03	NB	4.E-08	NB	6.E-05	NB
Mercury	2.E-04	2.E-05	4.E-02	4.E-03	2.E-03	2.E-04	**5.E+00**	5.E-01
Molybdenum	3.E-06	3.E-07	5.E-04	5.E-05	6.E-08	6.E-09	4.E-05	4.E-06
Nickel, Total	8.E-06	6.E-06	1.E-03	8.E-04	8.E-09	6.E-09	7.E-06	5.E-06
Silver	NB	NB	NB	NB	NB	NB	NB	NB
Zinc, Total	4.E-03	4.E-04	5.E-01	5.E-02	2.E-04	3.E-05	2.E-01	2.E-02
Total PCBs	1.E-06	1.E-07	0.E+00	0.E+00	1.E-04	1.E-05	2.E-01	2.E-02
Total DDT	4.E-05	4.E-06	1.E-02	1.E-03	1.E-03	1.E-04	1.E+00	1.E-01
Aldrin	NB	NB	NB	NB	NB	NB	NB	NB
Alpha Chlordane	1.E-08	2.E-09	2.E-06	5.E-07	5.E-07	9.E-08	7.E-04	1.E-04
delta-BHC	3.E-08	8.E-09	2.E-07	6.E-08	2.E-10	5.E-11	1.E-07	4.E-08
Dieldrin	5.E-07	NB	1.E-05	NB	7.E-10	NB	5.E-07	NB
Endosulfan I	4.E-09	NB	8.E-07	NB	1.E-11	NB	9.E-09	NB
Endosulfan II	1.E-08	NB	0.E+00	NB	0.E+00	NB	0.E+00	NB
Endosulfan sulfate	9.E-09	NB	2.E-06	NB	2.E-11	NB	1.E-08	NB
Endrin aldehyde	2.E-06	2.E-07	4.E-04	4.E-05	2.E-08	2.E-09	1.E-05	1.E-06
Endrin ketone	8.E-06	8.E-07	1.E-04	1.E-05	1.E-08	1.E-09	1.E-05	1.E-06
Gamma Chlordane	2.E-08	3.E-09	2.E-06	4.E-07	8.E-07	2.E-07	1.E-03	2.E-04
gamma-BHC (Lindane	3.E-08	3.E-09	4.E-06	4.E-07	1.E-10	1.E-11	7.E-08	7.E-09
Heptachlor	NB	NB	NB	NB	NB	NB	NB	NB
Heptachlor epoxide	NB	NB	NB	NB	NB	NB	NB	NB
Methoxychlor	NB	NB	NB	NB	NB	NB	NB	NB
Total PAHs	8.E-08	8.E-09	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
bis(2-ethylhexyl)phthal	3.E-06	NB	0.E+00	NB	1.E-05	NB	1.E-02	NB
Di-n-butylphthalate	3.E-05	3.E-06	0.E+00	0.E+00	5.E-05	5.E-06	3.E-02	3.E-03
Diethylphthalate	NB	NB	NB	NB	NB	NB	NB	NB
Acenaphthylene	*	*	*	*	*	*	*	*
Fluoranthene	*	*	*	*	*	*	*	*
Benzo(b)fluoranthene	*	*	*	*	*	*	*	*
Benzo(k)fluoranthene	*	*	*	*	*	*	*	*
Benzo(a)pyrene	*	*	*	*	*	*	*	*
Indeno(1,2,3-c-d)pyrer			*	*	*	*	*	*
Dibenz(a,h)anthracene					*	*	*	*
Dioxin - TEQ	4.E-04	4.E-05	5.E-02	5.E-03	1.E-04	1.E-05	1.E-01	1.E-02

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
* PAHs were evaluated as total PAHs for birds, but for individual compounds for
* Average scenario uses area use factors and migration factors where appropriate
* Maximum scenario assumes receptor is restricted to site
** Indicates Sensitivity analysis using larger foraging area (3 mile radius)

Table 7-20
Comparison of Surface Water Concentrations in Dead Creek Section F to Wildlife Benchmarks
Sauget Area I

Sample ID: / Compounds	SW-CSF-S1 Concentration	ER Q	SW-CSF-S2 Concentration	ER Q	SW-CSF-S3 Concentration	ER Q	NOAEL-Based Benchmarks [1] Water	Endpoint Species
Herbicides (ug/l)	ND		ND		ND			
Metals (mg/l)								
Aluminum	0.039	J	0.15	J	0.55		4.474	Whitetail deer
Arsenic	0.01	U	0.0032	J	0.0049	J	0.292	Whitetail deer
Barium	0.13		0.13		0.12		23.1	Whitetail deer
Cadmium	0.005	U	0.005	U	0.005	U	4.132	Whitetail deer
Chromium	0.01	U	0.01	U	0.01	U	4.3	Rough-winged Swallow
Copper	0.0016	J	0.002	J	0.012	J	65.2	Whitetail deer
Iron	0.5		0.55		1		NA	
Lead	0.005	U	0.0022	J	0.0037	J	4.86	Rough-winged Swallow
Manganese	0.082	J	0.1	J	0.14	J	377	Whitetail deer
Mercury	0.0002	U	0.0002	U	0.0002	U	1.93 [2]	Rough-winged Swallow
Molybdenum	0.01	U	0.01	U	0.0028	J	0.6	Whitetail deer
Nickel	0.0069	J	0.013	J	0.021	J	171.36	Whitetail deer
Silver	0.01	U	0.01	U	0.01	U	NA	
Zinc	0.0073	J	0.035		0.075		62.3	Rough-winged Swallow
PCB (ug/l)	ND		ND		ND			
Pesticides (ug/l)								
4,4'-DDT	0.1	U	0.1	U	0.1	U	12 [3]	Rough-winged Swallow
Aldrin	0.05	U	0.05	U	0.05	U	857	Whitetail deer
Alpha Chlordane	0.05	U	0.05	U	0.05	U	9200 [4]	Rough-winged Swallow
delta-BHC	0.012	U	0.012	U	0.012	U	100 [5]	River Otter
Dieldrin	0.1	U	0.1	U	0.1	U	86	Whitetail deer
Endosulfan I	0.05	U	0.05	U	0.05	U	640 a	Whitetail deer
Endosulfan II	0.1	U	0.1	U	0.1	U	640 a	Whitetail deer
Endosulfan sulfate	0.1	U	0.1	U	0.1	U	640 a	Whitetail deer
Endrin	0.1	U	0.1	U	0.1	U	43 b	Rough-winged Swallow
Endrin aldehyde	0.1	U	0.1	U	0.1	U	43 b	Rough-winged Swallow
Endrin ketone	0.1	U	0.1	U	0.1	U	43 b	Rough-winged Swallow
Gamma Chlordane	0.05	U	0.05	U	0.05	U	9200 [4]	Rough-winged Swallow
gamma-BHC (Lindane)	0.019	U	0.019	U	0.019	U	8590	Rough-winged Swallow
Heptachlor	0.05	U	0.05	U	0.05	U	557	Whitetail deer
Heptachlor epoxide	0.05	U	0.05	U	0.05	U	557 c	Whitetail deer
Methoxychlor	0.5	U	0.5	U	0.5	U	17100	Whitetail deer
SVOC (ug/l)								
Acenaphthylene	10	U	10	U	10	U	NA	
Benzo(a)pyrene	10	U	10	U	10	U	2320	Whitetail deer
Benzo(b)fluoranthene	10	U	10	U	10	U	NA	
Benzo(k)fluoranthene	10	U	10	U	10	U	NA	
bis(2-Ethylhexyl)phthalate	1.8	U	1.8	U	1.8	U	4730	Rough-winged Swallow
Di-n-butylphthalate	10	U	10	U	10	U	470	Rough-winged Swallow
Diethylphthalate	10	U	10	U	10	U	10623000	Whitetail deer
Fluoranthene	0.7	J	10	U	10	U	NA	
Indeno(1,2,3-cd)pyrene	10	U	10	U	10	U	NA	
Dioxins, ug/l								
2,3,7,8-TCDD TEQ Mammal	9.01197E-06		1.5012E-06		1.5583E-06		0.0007	Little Brown Bat
2,3,7,8-TCDD TEQ Bird	8.92962E-06		8.784E-07		9.922E-07		0.0602	Rough-winged swallow

[1] Sample, BE, DM Opresko, GW Suter. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Prepared for U.S. Department of Energy. Oak Ridge National Laboratory. June 1996. ES/ER/TM-86/R3.
[2] For inorganic Mercury only, does not include methyl mercury
[3] Value represents DDT and metabolites
[4] Value listed is for total chlordane

NA indicates not available; ND indicates not detected.
a Value for Endosulfan was used
b Value for Endrin was used
c Value for Heptachlor was used

Table 7-21
Comparison of Surface Water Concentrations in the Borrow Pit Lake to Wildlife Benchmarks
Sauget Area I

Sample ID: / Compounds	SW-BPL-S1 Concentration	ER Q	SW-BPL-S2 Concentration	ER Q	SW-BPL-S3 Concentration	ER Q	NOAEL-Based Benchmarks [1] Water	Endpoint Species
Herbicides (ug/l)	ND		ND		ND			
Metals (mg/l)								
Aluminum	3.4		0.71		0.65		4.474	Whitetail deer
Arsenic	0.015		0.0079	J	0.012		0.292	Whitetail deer
Barium	0.32		0.12		0.045		23.1	Whitetail deer
Cadmium	0.005	U	0.005	U	0.005	U	4.132	Whitetail deer
Chromium	0.0041	J	0.01	U	0.01	U	4.3	Rough-winged Swallow
Copper	0.0074	J	0.0036	J	0.0048	J	65.2	Whitetail deer
Iron	8.7	J	1.6	J	1.3	J	NA	
Lead	0.02		0.002	J	0.0029	J	4.86	Rough-winged Swallow
Manganese	1.7		0.13		0.17		377	Whitetail deer
Mercury	0.0002	U	0.0002	U	0.0002	U	1.93 [2]	Rough-winged Swallow
Molybdenum	0.0035	J	0.01	U	0.004	J	0.6	Whitetail deer
Nickel	0.015	J	0.012	J	0.0077	J	171.36	Whitetail deer
Silver	0.01	U	0.01	U	0.01	U	NA	
Zinc	0.048		0.027		0.017	J	62.3	Rough-winged Swallow
PCB (ug/l)	ND		ND		ND			
Pesticides (ug/l)								
4,4'-DDT	0.1	U	0.1	U	0.1	U	12 [3]	Rough-winged Swallow
Aldrin	0.05	U	0.05	U	0.05	U	857	Whitetail deer
Alpha Chlordane	0.05	U	0.05	U	0.05	U	9200 [4]	Rough-winged Swallow
delta-BHC	0.00013	J	0.0022	J	0.012	U	100 [5]	River Otter
Dieldrin	0.1	U	0.1	U	0.001	J	86	Whitetail deer
Endosulfan I	0.0024	J	0.05	U	0.0015	J	640 [a]	Whitetail deer
Endosulfan II	0.1	U	0.1	U	0.1	U	640 [a]	Whitetail deer
Endosulfan sulfate	0.1	U	0.1	U	0.0032	J	640 [a]	Whitetail deer
Endrin	0.1	U	0.1	U	0.00095	J	43 [b]	Rough-winged Swallow
Endrin aldehyde	0.0032	J	0.1	U	0.0016	J	43 [b]	Rough-winged Swallow
Endrin ketone	0.1	U	0.1	U	0.0027	J	43 [b]	Rough-winged Swallow
Gamma Chlordane	0.05	U	0.05	U	0.05	U	9200 [4]	Rough-winged Swallow
gamma-BHC (Lindane)	0.019	U	0.0038	J	0.0024	J	8590	Rough-winged Swallow
Heptachlor	0.0026	J	0.0022	J	0.0029	J	557	Whitetail deer
Heptachlor epoxide	0.00096	J	0.0009	J	0.05	U	557 [c]	Whitetail deer
Methoxychlor	0.5	U	0.5	U	0.5	U	17100	Whitetail deer
SVOC (ug/l)								
Acenaphthylene	10	U	10	U	10	U	NA	
Benzo(a)pyrene	10	U	10	U	10	U	2320	Whitetail deer
Benzo(b)fluoranthene	10	U	10	U	10	U	NA	
Benzo(k)fluoranthene	10	U	10	U	10	U	NA	
bis(2-Ethylhexyl)phthalate	1.8	U	1.8	U	1.8	U	4730	Rough-winged Swallow
Di-n-butylphthalate	10	U	10	U	10	U	470	Rough-winged Swallow
Diethylphthalate	10	U	10	U	10	U	10,623,000	Whitetail deer
Fluoranthene	10	U	10	U	10	U	NA	
Indeno(1,2,3-cd)pyrene	10	U	10	U	10	U	NA	
Dioxins (ug/l)								
2,3,7,8-TCDD TEQ Mammal [6]	8.5902E-07		7.453E-07		4.8413E-07		0.0007	Little Brown Bat
2,3,7,8-TCDD TEQ Bird [b]	3.4692E-07		3.475E-07		2.8163E-07		0.0602	Rough-winged swallow

[1] Sample, BE, DM Opresko, GW Suter. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Prepared for U.S. Department of Energy. Oak Ridge National Laboratory. June 1996. ES/ER/TM-86/R3.
[2] For inorganic Mercury only, does not include methyl mercury
[3] Value represents DDT and metabolites
[4] Value listed is for total chlordane
[5] Value represents BHC-mixed isomers
[6] Mammal and bird TEQ values were calculated for 2,3,7,8-TCDD
[a] Value for Endosulfan was used

Table 7-22
Comparison of Shrimp Concentrations Between the Borrow Pit Lake and both Reference Areas
Sauget Area I

Compound	Site Concentration	Reference Maximum	Reference Average
Herbicides (ug/kg)			
2,4-D	ND	ND	ND
Dicamba	ND	ND	ND
Dichloroprop	ND	ND	ND
MCPA	ND	ND	ND
MCPP	ND	4400	2700
Metals (mg/kg)			
Aluminum, Total	28	100	80
Antimony	**0.16**	**ND**	**ND**
Arsenic, Total	ND	1.2	1.1
Barium, Total	ND	ND	ND
Cadmium, Total	ND	ND	ND
Chromium, Total	0.23	0.28	0.27
Copper, Total	8.3	16	12
Iron	ND	ND	ND
Lead, Total	0.39	0.61	0.50
Manganese	ND	ND	ND
Mercury	ND	ND	ND
Molybdenum	ND	ND	ND
Nickel, Total	ND	ND	ND
Silver	**0.090**	**0.062**	**0.06**
Zinc, Total	16	17	16
Total PCBs (ug/kg)	ND	ND	ND
Pesticides (ug/kg)			
4,4'-DDD	ND	ND	ND
4,4'-DDE	ND	ND	ND
4,4'-DDT	ND	ND	ND
Aldrin	ND	ND	ND
Alpha Chlordane	ND	ND	ND
delta-BHC	ND	ND	ND
Dieldrin	ND	ND	ND
Endosulfan I	ND	ND	ND
Endosulfan II	ND	ND	ND
Endosulfan sulfate	ND	ND	ND
Endrin aldehyde	ND	ND	ND
Endrin ketone	ND	ND	ND
Gamma Chlordane	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND
Heptachlor	ND	ND	ND
Heptachlor epoxide	ND	ND	ND
Methoxychlor	ND	ND	ND
SVOC (ug/kg)			
bis(2-ethylhexyl)phthalate	ND	98	95
Di-n-butylphthalate	ND	ND	ND
Diethylphthalate	44	59	58
Acenaphthylene	ND	ND	ND
Fluoranthene	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND
Indeno(1,2,3-c-d)pyrene	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND
2,3,7,8-TCDD TEQ Mammal	0.000218	9.61E-05	6.44E-05
2,3,7,8-TCDD TEQ Bird	0.00172	7.45E-05	4.86E-05

Table 7-23
Comparison of Clam Concentrations Between the Borrow Pit Lake and both Reference Areas
Sauget Area I

Compound	Site Maximum	Site Average	Reference Maximum	Reference Average
Herbicides (ug/kg)				
2,4-D	ND	ND	ND	ND
Dicamba	ND	ND	ND	ND
Dichloroprop	32	18	87	35
MCPA	ND	ND	1400	7467
MCPP	**4000**	**5000**	**ND**	**ND**
Metals (mg/kg)				
Aluminum, Total	13	10.5	26	18.33
Antimony	ND	ND	ND	ND
Arsenic, Total	**0.96**	**1.8**	**0.65**	**1.75**
Barium, Total	ND	ND	ND	ND
Cadmium, Total	0.12	0.14	0.61	0.43
Chromium, Total	1.1	0.68	2.2	1.50
Copper, Total	0.99	0.86	2.4	2.13
Iron	ND	ND	ND	ND
Lead, Total	0.25	0.23	0.59	0.42
Manganese	ND	ND	ND	ND
Mercury	ND	ND	ND	ND
Molybdenum	ND	ND	ND	ND
Nickel, Total	ND	ND	ND	ND
Silver	**0.015**	**0.035**	**ND**	**ND**
Zinc, Total	22	15.0	52	36
Total PCBs (ug/kg)	ND	ND	ND	ND
Pesticides (ug/kg)				
4,4'-DDD	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND
Alpha Chlordane	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND
Endosulfan sulfate	ND	ND	ND	ND
Endrin aldehyde	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND
Gamma Chlordane	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND
Heptachlor	**2.3**	**3.55**	**ND**	**ND**
Heptachlor epoxide	ND	ND	ND	ND
Methoxychlor	**5.4**	**30**	**ND**	**ND**
SVOC (ug/kg)				
bis(2-ethylhexyl)phthalate	**170**	**99**	**ND**	**ND**
Di-n-butylphthalate	ND	ND	ND	ND
Diethylphthalate	**120**	**75**	**ND**	**ND**
Acenaphthylene	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND
Indeno(1,2,3-c-d)pyrene	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND	ND
2,3,7,8-TCDD TEQ Mammal	0.000146	8.3E-05	3.64E-05	2.44E-05
2,3,7,8-TCDD TEQ Bird	0.001303	0.000761	0.00025	0.00017

Table 7-24
Comparison of Floodplain Surface Soil Concentrations to Ecological Benchmarks
Sauget Area I

Constituent	Frequency of Detection in Soil	Maximum site concentration	95% UCL	95% UCL Represents Site Concentration	Twice Average Background Soil Concentration	Soil Benchmark[1]	Comment
Dioxins, ug/kg							
2,3,7,8-TCDD TEQ (mammals)[2]	100%	0.052	0.011	yes	0.124	0.00315	Maximum exceeds benchmark
Herbicides, ug/kg							
2,4-D	2%	9.60	NC	no	ND		Frequency less than 5%
2,4-DB	6%	41.00	6.62	yes	ND		No benchmark; ND in background
Dicamba	23%	23.00	4.90	yes	ND		No benchmark; ND in background
MCPA	20%	7400	1784	yes	14500		No benchmark; within background
MCPP	15%	7700	1859	yes	9967		No benchmark; within background
Metals, mg/kg							
Aluminum	100%	18000	10122	yes	25400		No benchmark; within background
Antimony	42%	2.60	1.24	yes	3.80	5	Maximum less than benchmark
Arsenic	100%	34.00	7.88	yes	19.13	9.9	Maximum exceeds benchmark
Barium	100%	1200	198	yes	363	283	Maximum exceeds benchmark
Beryllium	85%	1.10	0.62	yes	1.51	10	Maximum less than benchmark
Cadmium	100%	8.40	2.77	yes	8.65	4	Maximum exceeds benchmark
Calcium	100%	250000	30365	yes	33533		Low toxicity
Chromium	100%	49.00	17.93	yes	39		No benchmark; within background
Cobalt	100%	11.00	7.01	yes	16	20	Maximum less than benchmark
Copper	100%	230	80.94	yes	209	60	Maximum exceeds benchmark
Iron	100%	25000	16348	yes	38000		No benchmark; within background
Lead	100%	260	78.92	yes	185	40.5	Maximum exceeds benchmark
Magnesium	100%	21000	6448	yes	17233		Low toxicity
Manganese	100%	1200	429	yes	883		No benchmark; within background
Mercury	100%	0.57	0.08	yes	0.18		No benchmark; within background
Molybdenum	98%	3.20	0.81	yes	2.02	2	Maximum exceeds benchmark
Nickel	100%	55	20.02	yes	42.67	30	Maximum exceeds benchmark
Potassium	100%	3800	2135	yes	4733		Low toxicity
Selenium	25%	3.20	0.66	yes	ND	0.21	Maximum exceeds benchmark
Silver	49%	0.60	0.49	yes	1.35	2	Maximum less than benchmark
Thallium	26%	1.40	0.68	yes	ND	1	Maximum exceeds benchmark
Vanadium	100%	120	29.91	yes	69	2	Maximum exceeds benchmark
Zinc	100%	1400	332	yes	808	8.5	Maximum exceeds benchmark
PCBs, ug/kg							
Total PCBs	82%	385	90.43	yes	1200	371	Maximum exceeds benchmark
Pesticides, ug/kg							
4,4'-DDD	8%	36	3.01	yes	ND		No benchmark; ND in background
4,4'-DDE	54%	54	4..04	yes	16.12		No benchmark; within background
4,4'-DDT	48%	140	7.95	yes	14.12		No benchmark; within background
Aldrin	2%	23	1.68	yes	ND		Frequency less than 5%
Alpha Chlordane	20%	54	2.55	yes	ND		No benchmark; ND in background
alpha-BHC	2%	0.22	NC	no	ND		Frequency less than 5%
beta-BHC	11%	3.80	0.54	yes	ND		No benchmark; ND in background
delta-BHC	8%	0.24	0.22	yes	ND		No benchmark; ND in background
Dieldrin	29%	120	3.86	yes	ND		No benchmark; ND in background
Endosulfan II	2%	1.00	NC	no	ND		Frequency less than 5%
Endosulfan sulfate	18%	1.90	1.60	yes	ND		No benchmark; ND in background
Endrin	6%	6.10	2.31	yes	ND		No benchmark; ND in background
Endrin aldehyde	5%	5.06	2.16	yes	ND		No benchmark; ND in background
Endrin ketone	37%	4.9450	2.56	yes	ND		No benchmark; ND in background

Table 7-24
Comparison of Floodplain Surface Soil Concentrations to Ecological Benchmarks
Sauget Area I

Constituent	Frequency of Detection in Soil	Maximum site concentration	95% UCL	95% UCL Represents Site Concentration	Twice Average Background Soil Concentration	Soil Benchmark[1]	Comment
Gamma Chlordane	22%	78.00	3.26	yes	ND		No benchmark; ND in background
gamma-BHC (Lindane)	3%	0.1300	NC	no	ND		Frequency less than 5%
Heptachlor	6%	91	1.98	yes	ND		No benchmark; ND in background
Heptachlor epoxide	25%	30	2.04	yes	ND		No benchmark; ND in background
Methoxychlor	37%	38	11.61	yes	ND		No benchmark; ND in background
SVOCs, ug/kg							
2-Methylnaphthalene	5%	72	NC	no	ND		No benchmark; ND in background
Acenaphthene	14%	1200	124	yes	ND	20000	Maximum less than benchmark
Acenaphthylene	6%	75	174	no	ND		No benchmark; ND in background
Anthracene	23%	2300	152	yes	160		No benchmark; within background
Benzo(a)anthracene	57%	4300	266	yes	240		No benchmark; higher than background
Benzo(a)pyrene	40%	3600	226	yes	187		No benchmark; higher than background
Benzo(b)fluoranthene	55%	4400	282	yes	179		No benchmark; higher than background
Benzo(g,h,i)perylene	37%	2200	201	yes	127		No benchmark; higher than background
Benzo(k)fluoranthene	40%	3400	249	yes	208		No benchmark; higher than background
bis(2-Ethylhexyl)phthalate	29%	430	111	yes	322		No benchmark; within background
Butylbenzylphthalate	5%	340	103	yes	ND		No benchmark; ND in background
Carbazole	17%	1000	127	yes	64		No benchmark; higher than background
Chrysene	63%	4900	319	yes	273		No benchmark; higher than background
Dibenzo(a,h)anthracene	18%	810	90	yes	ND		No benchmark; ND in background
Dibenzofuran	8%	770	112	yes	ND		No benchmark; ND in background
Diethylphthalate	2%	39	NC	no	187	100000	Frequency less than 5%
Di-n-butylphthalate	15%	170	100	yes	312	200000	Maximum less than benchmark
Fluoranthene	60%	10000	558	yes	502		No benchmark; higher than background
Fluorene	11%	1400	126	yes	ND		No benchmark; ND in background
Indeno(1,2,3-cd)pyrene	28%	2000	195	yes	ND		No benchmark; ND in background
Naphthalene	3%	79	180	no	ND		Frequency less than 5%
Pentachlorophenol	55%	740	278	yes	742	3000	Maximum less than benchmark
Phenanthrene	52%	9200	366	yes	335		No benchmark; higher than background
Pyrene	49%	8500	443	yes	435		No benchmark; higher than background
VOCs, ug/kg							
2-Butanone (MEK)	35%	47.00	20.85	yes	ND		No benchmark; ND in background
2-Hexanone	5%	6.90	8.01	no	33.00		No benchmark; within background
Acetone	49%	670	283	yes	ND		No benchmark; ND in background
Benzene	8%	4.80	2.97	yes	ND		No benchmark; ND in background
Carbon disulfide	5%	4.30	2.98	yes	ND		No benchmark; ND in background
Chlorobenzene	2%	4.00	2.95	yes	ND	40000	Frequency less than 5%
Ethylbenzene	2%	3.00	2.78	yes	ND		Frequency less than 5%
Methylene chloride (Dichloromethane)	5%	2.40	2.36	yes	11.4		No benchmark; within background
Toluene	20%	12.0	3.34	yes	ND	200000	Maximum less than benchmark
Trichloroethene	6%	6.20	3.07	yes	ND		No benchmark; ND in background
Xylenes, Total	2%	4.20	2.99	yes	ND		Frequency less than 5%

[1]Efroymson et al., 1997. Preliminary Remediation Goals for Ecological Endpoints

[2]Calculated according to 1998 World Health Organization guidelines for mammals; Estimated Maximum Potential Concentration treated as non-detects.

Yellow shading indicates maximum site concentration exceeds benchmark.

Green shading indicates upper 95% UCL concentration (or maximum if 95% UCL not available) exceeds twice average background concentration (or constituent was not detected in background soil).

Table 7-25
Surface Soil Locations that Exceed Ecological Benchmarks
Sauget Area I

Constituent	Sample ID	Concentration	ER Q
Arsenic, mg/kg	Benchmark[1]	9.9	
	Background[2]	19	
	DAS-T4-S2-0-0.5FT	10	
	UAS-T1-S1-0-0.5FT	10	
	UAS-T2-S3-0-0.5FT	10	
	UAS-T7-S1-0-0.5FT	**34**	
Barium, mg/kg	Benchmark[1]	283	
	Background[2]	360	
	UAS-T4-S2-0-0.5FT	**1200**	
Cadmium, mg/kg	Benchmark[1]	4	
	Background[2]	8.6	
	DAS-T5-S3-0-0.5FT	5.7	
	DAS-T6-S1-0-0.5FT	4	
	UAS-T1-S1-0-0.5FT	4.8	
	UAS-T5-S6-0-0.5FT	8.4	
	UAS-T7-S1-0-0.5FT	5.4	
	UAS-T7-S7-0-0.5FT	6.1	
Copper, mg/kg	Benchmark[1]	60	
	Background[2]	190	
	DAS-T1-S1-0-0.5FT	98	J
	DAS-T1-S2-0-0.5FT	85	J
	DAS-T1-S3-0-0.5FT	73	J
	DAS-T2-S1-0-0.5FT	110	J
	DAS-T2-S3-0-0.5FT	94	J
	DAS-T3-S1-0-0.5FT	70	
	DAS-T3-S2-0-0.5FT	72	
	DAS-T3-S3-0-0.5FT	63	
	DAS-T4-S2-0-0.5FT	79	
	DAS-T4-S3-0-0.5FT	64	
	DAS-T5-S1-0-0.5FT	75	
	DAS-T5-S3-0-0.5FT	70	
	UAS-T1-S1-0-0.5FT	150	
	UAS-T1-S2-0-0.5FT	**230**	
	UAS-T1-S3-0-0.5FT	**230**	
	UAS-T1-S4-0-0.5FT	160	
	UAS-T1-S5-0-0.5FT	130	
	UAS-T1-S6-0-0.5FT	86	
	UAS-T1-S7-0-0.5FT	77	
	UAS-T2-S1-0-0.5FT	140	
	UAS-T2-S2-0-0.5FT	77	
	UAS-T2-S3-0-0.5FT	87	
	UAS-T2-S4-0-0.5FT	95	
	UAS-T2-S5-0-0.5FT	69	
	UAS-T2-S6-0-0.5FT	87	
	UAS-T3-S2-0-0.5FT	65	
	UAS-T3-S3-0-0.5FT	52	J
	UAS-T3-S4-0-0.5FT	77	
	UAS-T3-S5-0-0.5FT	79	
	UAS-T3-S7-0-0.5FT	75	
	UAS-T4-S1-0-0.5FT	69	
	UAS-T4-S2-0-0.5FT	180	
	UAS-T4-S7-0-0.5FT	60	
	UAS-T5-S6-0-0.5FT	85	
	UAS-T7-S1-0-0.5FT	130	

Table 7-25
Surface Soil Locations that Exceed Ecological Benchmarks
Sauget Area I

Constituent	Sample ID	Concentration	ER Q
Lead, mg/kg	Benchmark[1]	40.5	
	Background[2]	180	
	DAS-T1-S1-0-0.5FT	96	J
	DAS-T1-S2-0-0.5FT	50	J
	DAS-T1-S3-0-0.5FT	50	J
	DAS-T2-S1-0-0.5FT	88	J
	DAS-T2-S3-0-0.5FT	76	J
	DAS-T3-S1-0-0.5FT	53	J
	DAS-T3-S2-0-0.5FT	90	J
	DAS-T3-S3-0-0.5FT	53	J
	DAS-T4-S1-0-0.5FT	75	J
	DAS-T4-S2-0-0.5FT	96	J
	DAS-T4-S3-0-0.5FT	50	J
	DAS-T5-S1-0-0.5FT	130	J
	DAS-T5-S3-0-0.5FT	130	J
	DAS-T6-S1-0-0.5FT	110	J
	DAS-T6-S3-0-0.5FT	87	J
	DAS-T7-S2-0-0.5FT	67	J
	UAS-T1-S1-0-0.5FT	93	
	UAS-T1-S2-0-0.5FT	92	
	UAS-T1-S3-0-0.5FT	120	
	UAS-T1-S4-0-0.5FT	73	
	UAS-T1-S5-0-0.5FT	69	
	UAS-T1-S7-0-0.5FT	46	
	UAS-T2-S1-0-0.5FT	79	
	UAS-T2-S2-0-0.5FT	50	
	UAS-T2-S3-0-0.5FT	66	
	UAS-T2-S4-0-0.5FT	72	
	UAS-T2-S5-0-0.5FT	48	
	UAS-T2-S6-0-0.5FT	79	
	UAS-T3-S2-0-0.5FT	63	
	UAS-T3-S4-0-0.5FT	64	
	UAS-T3-S5-0-0.5FT	56	
	UAS-T3-S7-0-0.5FT	51	J
	UAS-T4-S1-0-0.5FT	62	
	UAS-T4-S2-0-0.5FT	**190**	
	UAS-T4-S5-0-0.5FT	83	
	UAS-T4-S6-0-0.5FT	130	
	UAS-T4-S7-0-0.5FT	**260**	
	UAS-T5-S1-0-0.5FT	59	
	UAS-T5-S2-0-0.5FT	50	
	UAS-T5-S3-0-0.5FT	54	
	UAS-T5-S4-0-0.5FT	50	
	UAS-T5-S5-0-0.5FT	45	
	UAS-T5-S6-0-0.5FT	170	
	UAS-T6-S5-0-0.5FT	78	J
	UAS-T7-S1-0-0.5FT	71	J
	UAS-T7-S2-0-0.5FT	41	J
	UAS-T7-S3-0-0.5FT	64	J
	UAS-T7-S5-0-0.5FT	42	J
	UAS-T7-S6-0-0.5FT	72	J
	UAS-T7-S7-0-0.5FT	150	J
Molybdenum, mg/kg	Benchmark[1]	2	
	Background[2]	2	
	UAS-T4-S5-0-0.5FT	**2.3**	
	UAS-T6-S5-0-0.5FT	**3.2**	
Nickel, mg/kg	Benchmark[1]	30	
	Background[2]	43	
	UAS-T7-S1-0-0.5FT	**55**	

Table 7-25
Surface Soil Locations that Exceed Ecological Benchmarks
Sauget Area I

Constituent	Sample ID	Concentration	ER Q
Selenium, mg/kg	Benchmark[1]	0.21	
	Background[2]	ND	
	DAS-T2-S3-0-0.5FT	0.55	J
	DAS-T4-S2-0-0.5FT	0.88	J
	UAS-T1-S1-0-0.5FT	0.81	J
	UAS-T1-S5-0-0.5FT	0.72	J
	UAS-T2-S4-0-0.5FT	0.61	J
	UAS-T2-S6-0-0.5FT	1	J
	UAS-T3-S5-0-0.5FT	0.6	J
	UAS-T3-S7-0-0.5FT	3.2	
	UAS-T5-S4-0-0.5FT	0.48	J
	UAS-T6-S5-0-0.5FT	0.68	J
	UAS-T7-S1-0-0.5FT	1.1	
	UAS-T7-S2-0-0.5FT	0.49	J
	UAS-T7-S3-0-0.5FT	0.89	J
	UAS-T7-S4-0-0.5FT	0.55	J
	UAS-T7-S6-0-0.5FT	1.1	
	UAS-T7-S7-0-0.5FT	0.53	J
Thallium, mg/kg	Benchmark[1]	1	
	Background[2]	ND	
	DAS-T2-S2-0-0.5FT	1.3	
	DAS-T3-S2-0-0.5FT	1.4	
	DAS-T4-S2-0-0.5FT	1.1	J
	DAS-T4-S3-0-0.5FT	1.1	J

Table 7-25
Surface Soil Locations that Exceed Ecological Benchmarks
Sauget Area I

Constituent	Sample ID	Concentration	ER Q
Vanadium, mg/kg	Benchmark[1]	2	
	Background[2]	69	
	DAS-T1-S1-0-0.5FT	19	
	DAS-T1-S2-0-0.5FT	25	
	DAS-T1-S3-0-0.5FT	18	
	DAS-T2-S1-0-0.5FT	24	
	DAS-T2-S2-0-0.5FT	120	
	DAS-T2-S3-0-0.5FT	34	
	DAS-T3-S1-0-0.5FT	23	
	DAS-T3-S2-0-0.5FT	25	
	DAS-T3-S3-0-0.5FT	20	
	DAS-T4-S1-0-0.5FT	21	
	DAS-T4-S2-0-0.5FT	35	
	DAS-T4-S3-0-0.5FT	34	J
	DAS-T5-S1-0-0.5FT	19	
	DAS-T5-S2-0-0.5FT	19	
	DAS-T5-S3-0-0.5FT	17	
	DAS-T6-S1-0-0.5FT	22	J
	DAS-T6-S2-0-0.5FT	22	J
	DAS-T6-S3-0-0.5FT	17	J
	DAS-T7-S1-0-0.5FT	25	
	DAS-T7-S2-0-0.5FT	22	
	UAS-T1-S1-0-0.5FT	32	
	UAS-T1-S2-0-0.5FT	35	
	UAS-T1-S3-0-0.5FT	41	
	UAS-T1-S4-0-0.5FT	36	
	UAS-T1-S5-0-0.5FT	35	
	UAS-T1-S6-0-0.5FT	22	
	UAS-T1-S7-0-0.5FT	21	
	UAS-T2-S1-0-0.5FT	30	
	UAS-T2-S2-0-0.5FT	28	
	UAS-T2-S3-0-0.5FT	40	J
	UAS-T2-S4-0-0.5FT	46	
	UAS-T2-S5-0-0.5FT	30	J
	UAS-T2-S6-0-0.5FT	28	J
	UAS-T3-S1-0-0.5FT	30	
	UAS-T3-S2-0-0.5FT	39	J
	UAS-T3-S3-0-0.5FT	26	J
	UAS-T3-S4-0-0.5FT	42	J
	UAS-T3-S5-0-0.5FT	27	J
	UAS-T3-S6-0-0.5FT	23	J
	UAS-T3-S7-0-0.5FT	13	
	UAS-T4-S1-0-0.5FT	23	
	UAS-T4-S2-0-0.5FT	22	
	UAS-T4-S3-0-0.5FT	27	
	UAS-T4-S4-0-0.5FT	15	
	UAS-T4-S5-0-0.5FT	26	
	UAS-T4-S6-0-0.5FT	29	
	UAS-T4-S7-0-0.5FT	26	
	UAS-T5-S1-0-0.5FT	29	
	UAS-T5-S2-0-0.5FT	29	
	UAS-T5-S3-0-0.5FT	25	
	UAS-T5-S4-0-0.5FT	26	
	UAS-T5-S5-0-0.5FT	28	
	UAS-T5-S6-0-0.5FT	27	
	UAS-T6-S1-0-0.5FT	25	
	UAS-T6-S2-0-0.5FT	24	
	UAS-T6-S3-0-0.5FT	30	
	UAS-T6-S4-0-0.5FT	33	
	UAS-T6-S5-0-0.5FT	30	
	UAS-T7-S1-0-0.5FT	27	
	UAS-T7-S2-0-0.5FT	25	
	UAS-T7-S3-0-0.5FT	33	
	UAS-T7-S4-0-0.5FT	22	
	UAS-T7-S5-0-0.5FT	26	
	UAS-T7-S6-0-0.5FT	22	
	UAS-T7-S7-0-0.5FT	21	

Table 7-25
Surface Soil Locations that Exceed Ecological Benchmarks
Sauget Area I

Constituent	Sample ID	Concentration	ER Q
Zinc, mg/kg	Benchmark[1]	8.5	
	Background[2]	810	
	DAS-T1-S1-0-0.5FT	300	J
	DAS-T1-S2-0-0.5FT	230	J
	DAS-T1-S3-0-0.5FT	250	J
	DAS-T2-S1-0-0.5FT	290	J
	DAS-T2-S2-0-0.5FT	140	J
	DAS-T2-S3-0-0.5FT	260	J
	DAS-T3-S1-0-0.5FT	220	J
	DAS-T3-S2-0-0.5FT	240	J
	DAS-T3-S3-0-0.5FT	260	J
	DAS-T4-S1-0-0.5FT	240	J
	DAS-T4-S2-0-0.5FT	310	
	DAS-T4-S3-0-0.5FT	180	
	DAS-T5-S1-0-0.5FT	330	J
	DAS-T5-S2-0-0.5FT	140	J
	DAS-T5-S3-0-0.5FT	750	J
	DAS-T6-S1-0-0.5FT	350	
	DAS-T6-S2-0-0.5FT	110	
	DAS-T6-S3-0-0.5FT	240	
	DAS-T7-S1-0-0.5FT	**870**	
	DAS-T7-S2-0-0.5FT	260	
	UAS-T1-S1-0-0.5FT	**1400**	J
	UAS-T1-S2-0-0.5FT	340	J
	UAS-T1-S3-0-0.5FT	390	J
	UAS-T1-S4-0-0.5FT	280	J
	UAS-T1-S5-0-0.5FT	270	J
	UAS-T1-S6-0-0.5FT	180	J
	UAS-T1-S7-0-0.5FT	250	J
	UAS-T2-S1-0-0.5FT	310	J
	UAS-T2-S2-0-0.5FT	190	J
	UAS-T2-S3-0-0.5FT	250	J
	UAS-T2-S4-0-0.5FT	270	J
	UAS-T2-S5-0-0.5FT	210	J
	UAS-T2-S6-0-0.5FT	290	J
	UAS-T3-S1-0-0.5FT	160	
	UAS-T3-S2-0-0.5FT	240	
	UAS-T3-S3-0-0.5FT	160	J
	UAS-T3-S4-0-0.5FT	300	
	UAS-T3-S5-0-0.5FT	410	
	UAS-T3-S6-0-0.5FT	250	
	UAS-T3-S7-0-0.5FT	460	
	UAS-T4-S1-0-0.5FT	240	
	UAS-T4-S2-0-0.5FT	290	
	UAS-T4-S3-0-0.5FT	76	
	UAS-T4-S4-0-0.5FT	82	
	UAS-T4-S5-0-0.5FT	120	
	UAS-T4-S6-0-0.5FT	140	
	UAS-T4-S7-0-0.5FT	550	
	UAS-T5-S1-0-0.5FT	230	
	UAS-T5-S2-0-0.5FT	230	
	UAS-T5-S3-0-0.5FT	240	
	UAS-T5-S4-0-0.5FT	230	
	UAS-T5-S5-0-0.5FT	240	
	UAS-T5-S6-0-0.5FT	**980**	
	UAS-T6-S1-0-0.5FT	160	J
	UAS-T6-S2-0-0.5FT	82	J
	UAS-T6-S3-0-0.5FT	90	J
	UAS-T6-S4-0-0.5FT	99	J
	UAS-T6-S5-0-0.5FT	120	J
	UAS-T7-S1-0-0.5FT	610	
	UAS-T7-S2-0-0.5FT	190	
	UAS-T7-S3-0-0.5FT	270	
	UAS-T7-S4-0-0.5FT	150	
	UAS-T7-S5-0-0.5FT	160	
	UAS-T7-S6-0-0.5FT	310	
	UAS-T7-S7-0-0.5FT	640	

Table 7-25
Surface Soil Locations that Exceed Ecological Benchmarks
Sauget Area I

Constituent	Sample ID	Concentration	ER Q
Total PCBs, ug/kg	Benchmark[1]	371	
	Background[2]	1200	
	UAS-T6-S2-0-0.5FT	385	
2,3,7,8-TCDD TEQ (mammals) in ug/kg	Benchmark[1]	0.00315	
	Background[2]	0.124	
	DAS-T1-S1-0-0.5FT	0.0235855	
	DAS-T1-S2-0-0.5FT	0.016399	
	DAS-T1-S3-0-0.5FT	0.014051	
	DAS-T2-S1-0-0.5FT	0.02144	
	DAS-T2-S2-0-0.5FT	0.012195	
	DAS-T2-S3-0-0.5FT	0.017101	
	DAS-T3-S1-0-0.5FT	0.007658	
	DAS-T3-S2-0-0.5FT	0.008586	
	DAS-T3-S3-0-0.5FT	0.00766	
	DAS-T4-S1-0-0.5FT	0.016645	
	DAS-T4-S2-0-0.5FT	0.006258	
	DAS-T4-S3-0-0.5FT	0.006696	
	DAS-T5-S1-0-0.5FT	0.005006	
	DAS-T5-S2-0-0.5FT	0.005483	
	DAS-T5-S3-0-0.5FT	0.02432	
	DAS-T6-S1-0-0.5FT	0.009106	
	DAS-T6-S2-0-0.5FT	0.004063	
	DAS-T6-S3-0-0.5FT	0.006762	
	DAS-T7-S1-0-0.5FT	0.0034335	
	DAS-T7-S2-0-0.5FT	0.008225	
	UAS-T1-S1-0-0.5FT	0.01856	
	UAS-T1-S6-0-0.5FT	0.015206	
	UAS-T2-S4-0-0.5FT	0.01974	
	UAS-T3-S3-0-0.5FT	0.005056	
	UAS-T4-S1-0-0.5FT	0.008645	
	UAS-T4-S6-0-0.5FT	**0.187423**	
	UAS-T5-S4-0-0.5FT	0.00562	
	UAS-T6-S3-0-0.5FT	0.01658	
	UAS-T7-S3-0-0.5FT	0.0087385	

[1]Efroymson et al., 1997. Preliminary Remediation Goals for Ecological Endpoints.

[2]Background concentration is twice average concentration for three background soil samples.

Shading indicates concentrations exceeds benchmark and background.

Table 8-1
Weight of Evidence Evaluation of Ecological Risk
Sauget Area I

Harm/Magnitude	Assessment Endpoint 1			Assessment Endpoint 2			Assessment Endpoint 3			Assessment Endpoint 4		
	Sustainability of warm water fish			*Survival, growth, and reproduction of aquatic wildlife species*			*Survival, growth, and reproduction of bald eagles*			*Survival, growth, and reproduction of terrestrial wildlife in floodplain*		
	Weighing Factors (Increasing Confidence or Weight) →			**Weighing Factors** (Increasing Confidence or Weight) →			**Weighing Factors** (Increasing Confidence or Weight) →			**Weighing Factors** (Increasing Confidence or Weight) →		
	Low Weight	Medium Weight	High Weight	Low Weight	Medium Weight	High Weight	Low Weight	Medium Weight	High Weight	Low Weight	Medium Weight	High Weight
Yes/High												
Yes/Low	**1c** - COPCs exceed sediment guidelines for benthic invertebrates	**1a** - fish body burdens indicate higher exposure to some COPCS than reference areas; mercury concentrations in some fish exceed toxic benchmark		**2d** - food chain modeling indicated potential risk to great blue heron that eats fish due to mercury	**2b, 2d, 2e** - concentrations in plants, fish, clams, and shrimp indicate higher exposure than reference areas			**3a** - concentrations in fish indicate higher exposure than reference areas		**4a** - concentratons of COPCs in surface soil exceed some screening benchmarks		
Undetermined												
No Risk		**1c** - benthic community is impaired to same degree as reference area **1c** - sediments exhibit toxicity to similar degree as reference areas	**1b** - COPCs that exceed surface water criteria are at background levels	**2a** - species use of habitat appears similar to reference areas **2b, 2e** - food chain modeling indicated no risk to mallards that eat plants; risks to muskrats eating plants and clams due to aluminum is similar to reference areas **2d, 2e** - food chain modeling indicated no risk to river otter that eats fish or clams; no risk to mallard that eats shrimp	**2c** - surface water concentratons do not present a risk to wildlife		**3a** - food chain modeling indicated no risk to bald eagles eating fish from Borrow Pit					

Line of Evidence Category Key	
	FIELD OBSERVATIONS
	LABORATORY
	LITERATURE
	MODELING

FIGURES

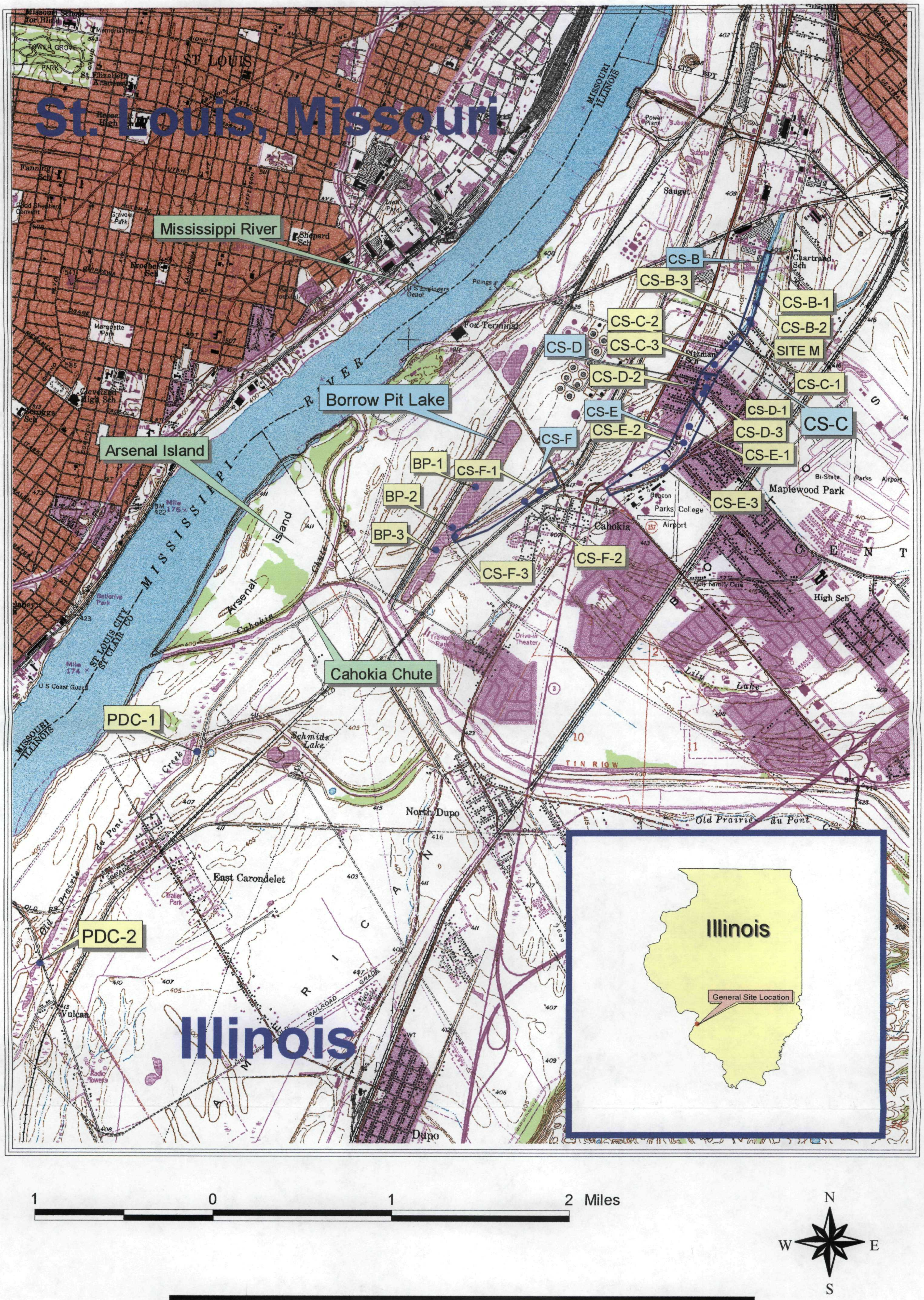
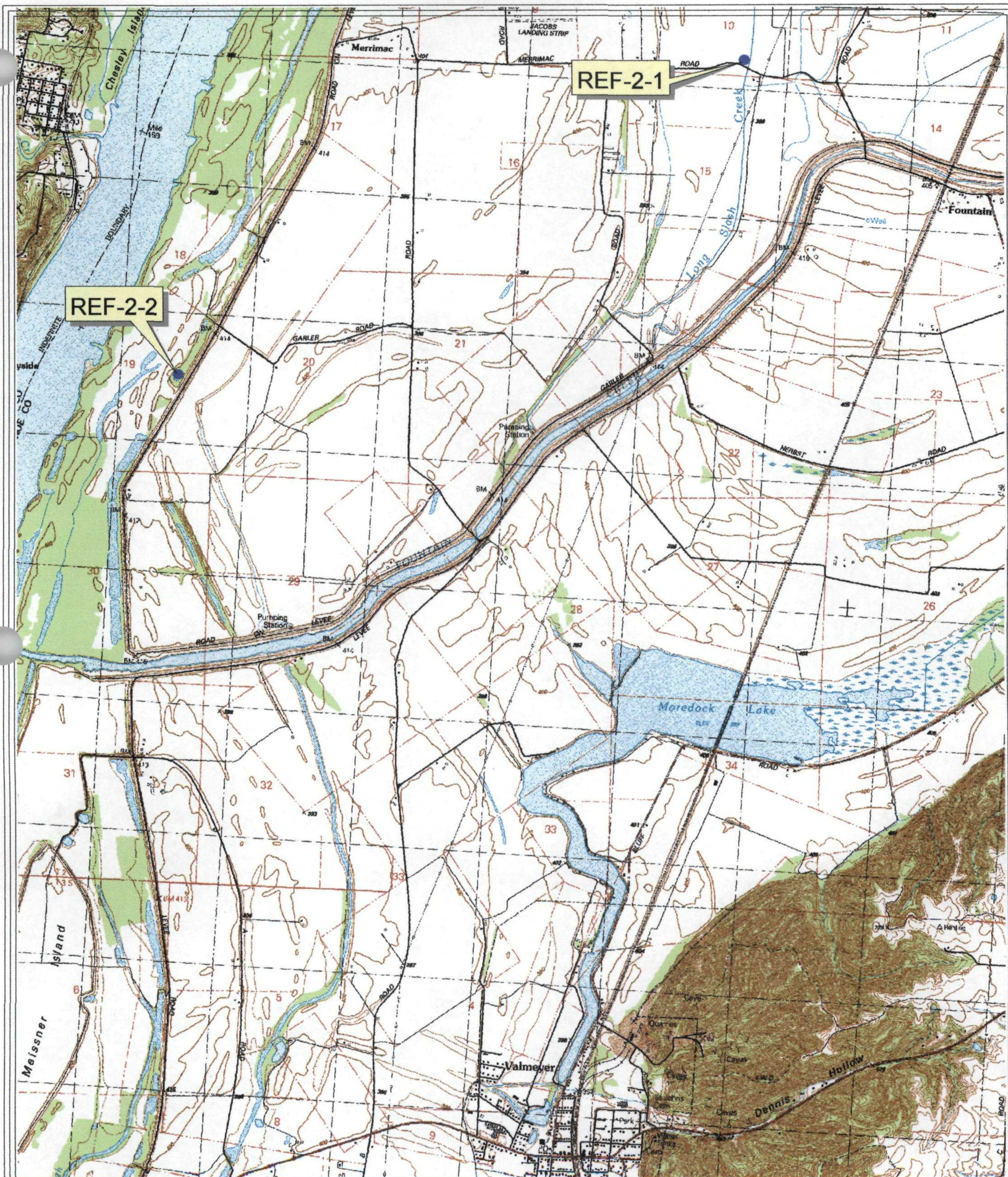


Figure 1-1: Site Locus and Sample Locations
Sauget Area 1
Sauget, Illinois

Figure 2-1: Monroe County Reference Areas
Sauget Area 1
Sauget, Illinois



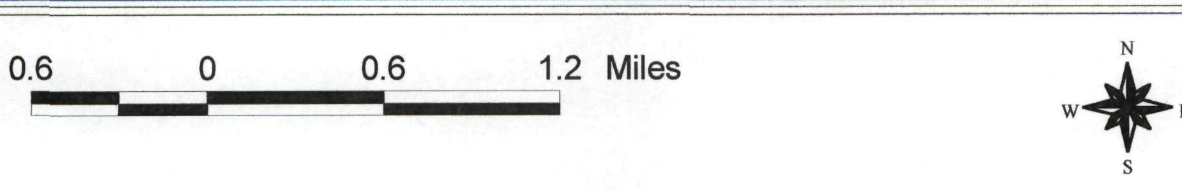
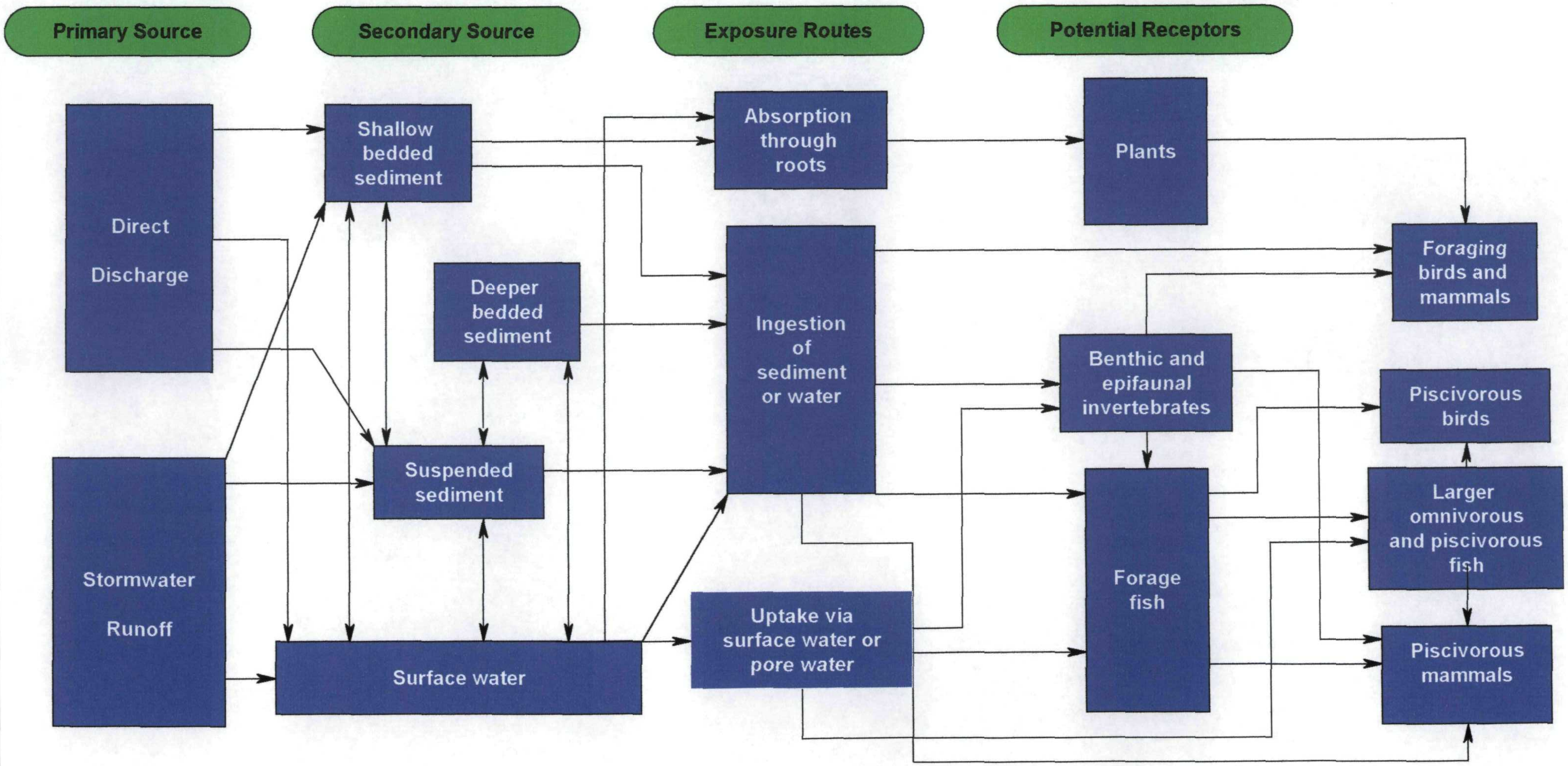
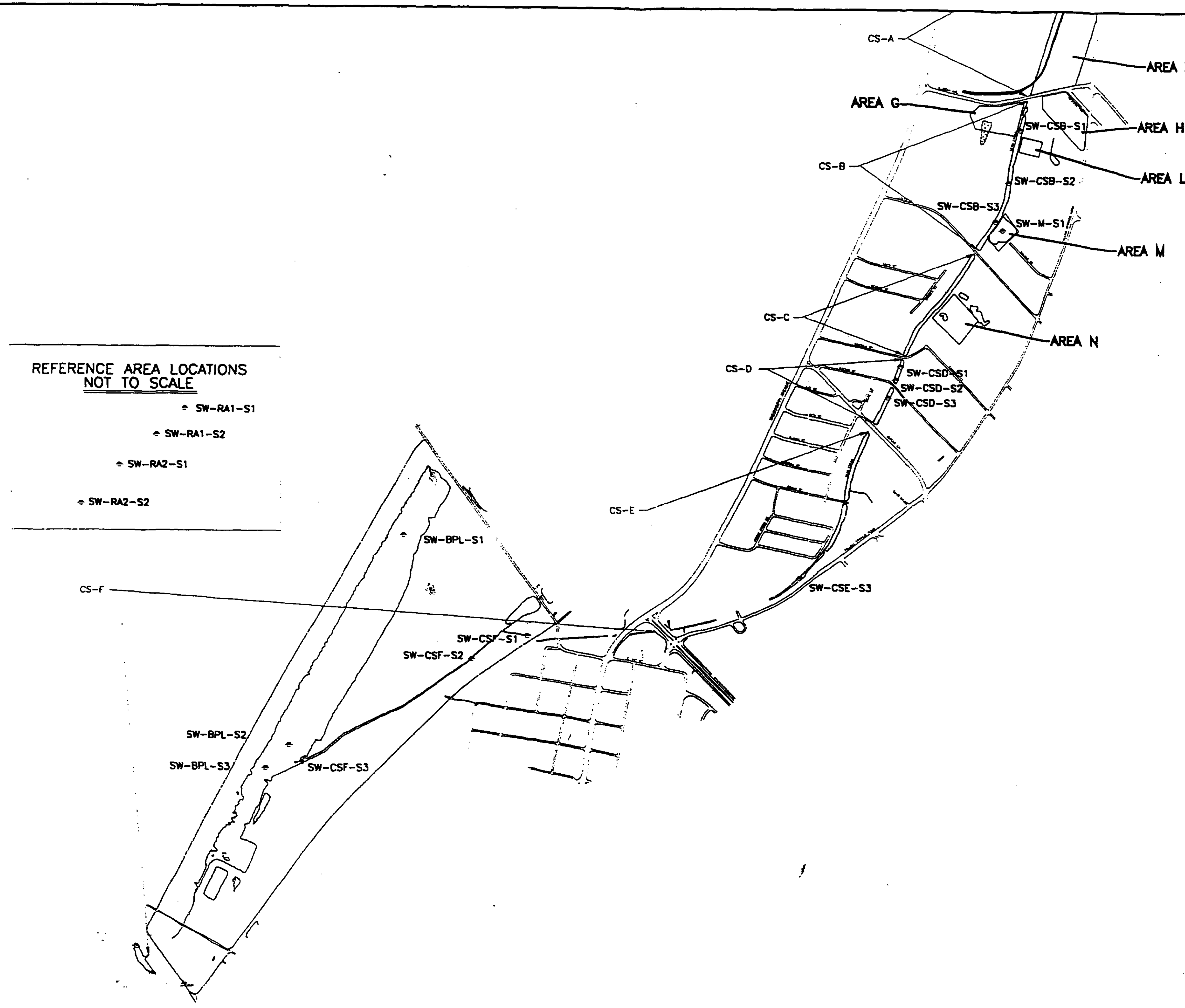


Figure 3-1: Ecological Conceptual Model for Dead Creek





Areas G, H, I, L, M, N, are APPROXIMATE fill boundaries based on aerial photo review.

FIGURE 5-1

LEGEND

- SURFACE WATER SAMPLING LOCATION

CS-A CREEK SEGMENT

AREA H FILL AREA

WATER BODY

SOLUTIA INC.
REMEDIATION TECHNOLOGY GROUP
ST. LOUIS, MISSOURI

SAUGET AREA 1
SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, ILLINOIS

SURFACE WATER SAMPLE LOCATIONS

600 0 600
SCALE IN FEET

FILE NO. 25501.FIGS
SEPTEMBER 2000

O'BRIEN & GERE ENGINEERS, INC.

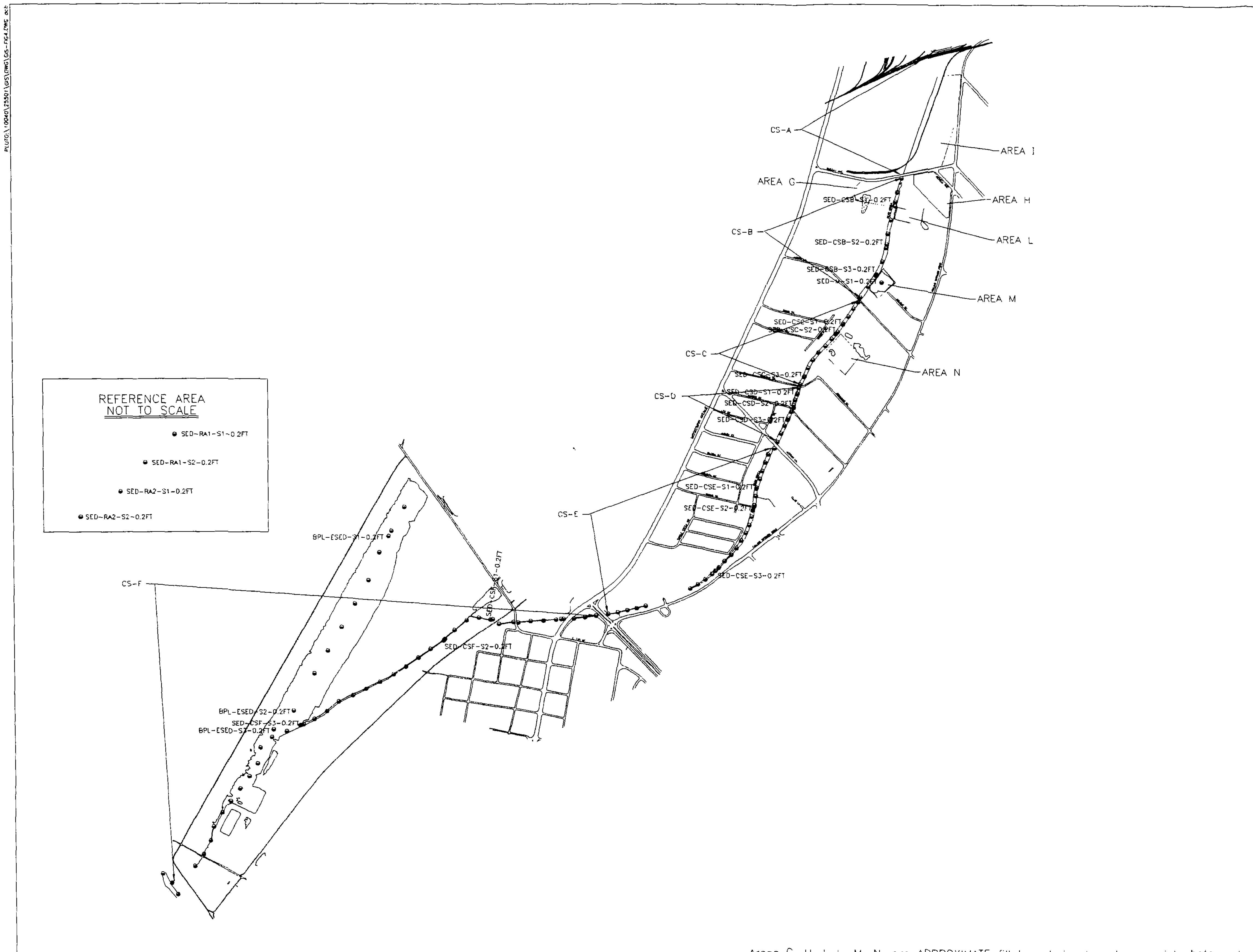


Figure 5-2

LEGEND
- SEDIMENT SAMPLE LOCATION
- CS-A CREEK SEGMENT
- AREA H FILL AREA
- WATER BODY

SOLUTIA INC.
REMEDIATION TECHNOLOGY GROUP
ST. LOUIS, MISSOURI

SAUGET AREA 1
SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, ILLINOIS

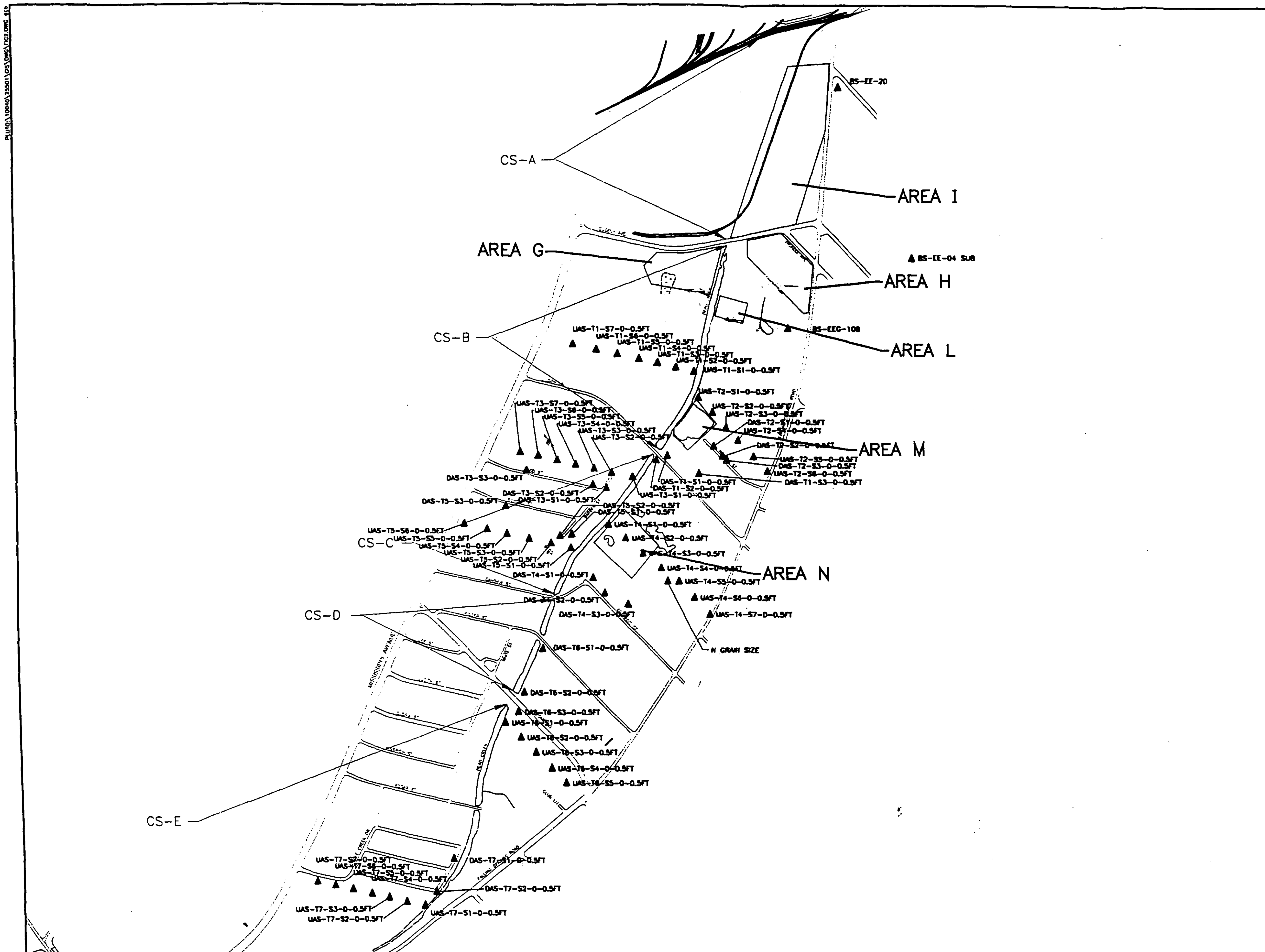
SEDIMENT
SAMPLE LOCATIONS

600 0 600
SCALE IN FEET

FILE NO 25501.FIG4
SEPTEMBER 2000

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 5-3



Areas G, H, I, L, M, N, are APPROXIMATE fill boundaries based on aerial photo review.

LEGEND

▲	SOIL SAMPLING LOCATION
CS-A	CREEK SEGMENT
AREA H	FILL AREA
	WATER BODY

NOTE: SURFACE SOILS WERE COLLECTED AT 0-.5ft. SUBSURFACE SOILS WERE COLLECTED AT 3-6ft. SAMPLE IDENTIFICATIONS ARE DEPICTED FOR SURFACE SOILS SAMPLES.

SOLUTIA INC.
REMEDIATION TECHNOLOGY GROUP
ST. LOUIS, MISSOURI

SAUGET AREA 1
SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, ILLINOIS

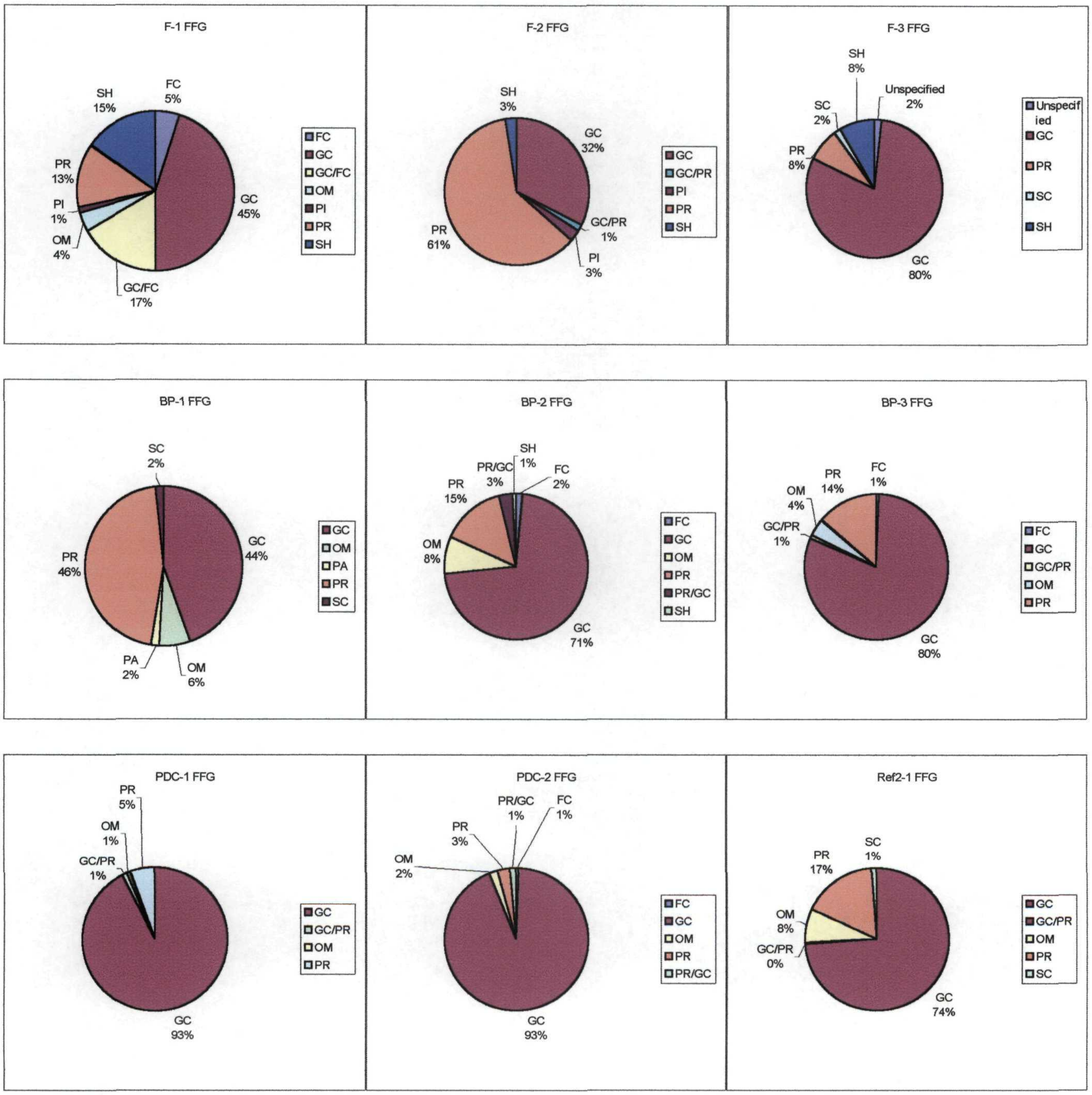
SOIL SAMPLING LOCATIONS

400 0 400
SCALE IN FEET

FILE NO. 25501.FIG2
SEPTEMBER 2000

O'BRIEN & GERE ENGINEERS, INC.

Figure 7-1
Summary of Functional Feeding Group (FFG) Abundance
Dead Creek Section F, Borrow Pit Lake, and Reference Areas
Sauget Area I



FC: Filter/collector
GC: Gatherer/collector
OM: Omnivore
PA: Parasite
PI: Piercer
PR: Predator
SC: Scraper
SH: Shredder

APPENDIX A

ECOLOGICAL RISK ASSESSMENT WORK PLAN

FOR SAUGET AREA 1

ECOLOGICAL RISK ASSESSMENT WORK PLAN
FOR
SAUGET AREA I

SAUGET, ST. CLAIR COUNTY, ILLINOIS

August 11, 1999

Prepared for:

Solutia, Inc.
10300 Olive Boulevard
St. Louis, Missouri 63166-6760

Prepared by:

Menzie-Cura & Associates, Inc.
One Courthouse Lane, Suite Two
Chelmsford, Massachusetts 01824
Phone: (978) 453-4300

TABLE OF CONTENTS:

1.0 INTRODUCTION

1.1 Goals and Objectives

This document is a workplan for a baseline ecological risk assessment at the Sauget Area I in Sauget, Illinois. The plan addresses Dead Creek Segments B, M, C, D, E, and F, and recent USEPA comments regarding the development of a baseline ecological risk assessment for this area (USEPA, 1999). It is also contingent upon a planned field reconnaissance of the subject areas. In particular, this planned reconnaissance will help to finalize sampling locations, receptors, and the location of a reference area. Observations made during the reconnaissance may necessitate alterations in the workplan. We will communicate such proposed alterations in a technical amendment to the plan, should they occur.

The plan follows current United States Environmental Protection Agency (USEPA) guidance in:

> *Ecological Risk Assessment Guidance For Superfund: Process For Designing and Conducting Ecological Risk Assessments* (USEPA, 1997a); and
>
> *Guidelines for Ecological Risk Assessment* (EPA/630/R-95/002F, April, 1998).

The USEPA 1997 guidance document provides an eight-step process. Steps 1 and 2 of this process are a screening level assessment, and Steps 3 through 7 provide guidance for a baseline assessment. The screening level assessment may conclude that site data indicate either:

> a negligible ecological risk and therefore the site requires no further study; or, there is (or might be) a risk of adverse ecological effects, and the ecological risk assessment process will continue.

Previously, the USEPA conducted a Preliminary Ecological Assessment of Dead Creek Segment F, which essentially provides the screening analyses required in Steps 1 and 2 of the guidance (USEPA, 1997b). This USEPA assessment concluded that the site warrants further investigation. Therefore this Work Plan addresses the various elements of Steps 3 through 7 of USEPA guidance for designing a baseline ecological risk assessment to Segment F, as well as Segments B, C, D, E even though they have not been subject to a prior screening level assessment. The workplan includes:

- Description of a Site Conceptual Model;
- Selection of Chemicals of Ecological Concern;
- Identification of Assessment Endpoints;
- Selection of Receptors;
- Selection of Measures of effects and their relation to assessment endpoints;
- Risk Characterization;
- Discussion of Uncertainties and Assumptions.

The workplan will explain how the baseline risk assessment will use data described in the Quality Assurance Project Plan/Field-Sampling Plan (QAPP/FSP), that has been prepared and submitted separately. The FSP for the baseline ecological risk assessment describes the details of the field sampling effort as well as the data analysis methods and data quality objectives (DQOs). These include methods for:

conducting a field reconnaissance;

collecting vegetation and benthic organisms in Creek Sectors B to F, M, and the reference areas, and analyzing them for target analytes;

collecting forage fish, predator fish, bottom fish and crayfish in Creek Sector F and the reference areas, and analyzing them for target analytes (we will also collect these organisms in segments B,C,D,E, and, M if observed in those areas);

collecting sediments in Creek Sectors B to F, M, and the reference areas for sediment toxicity testing;

collecting sediments in Creek Sectors B to F, M, and the reference areas for benthic community analysis.

Please refer to the QAPP/FSP for details of field sampling, number of stations, and station locations, and analytical methods.

2.0 SITE CONCEPTUAL MODEL

2.1 Ecological Observations

We will conduct a reconnaissance survey to provide more details and more current information regarding ecological conditions at the various creek sectors. This section provides a description of the site as observed on 29-30 July 1996, when Menzie-Cura & Associates, Inc. personnel (David Peterson, Certified Wildlife Biologist), visited the Sauget Area 1 in Sauget and Cahokia, Illinois and conducted an evaluation of local habitats. The areas observed at that time included ecological resources along: Dead Creek, Prairie du Pont Creek, the associated wetlands, Cahokia Chute, and the Mississippi River. In addition, we contacted federal/state agencies and private conservation organizations concerning additional ecological information available about the area (see Attached List).

Potentially sensitive environments in the Dead Creek area include: Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened (T/E) Species, Habitat Known to be Used by State Designated Endangered or Threatened Species, and Wetlands.

Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened Species

According to the records of the Illinois Department of Natural Resources' Natural Heritage Inventory, the only federally endangered or threatened species in the study area is the federally threatened bald eagle (*Haliaeetus leucocephalus*). In 1993, a pair of eagles unsuccessfully attempted to nest at the southern tip of Arsenal Island, where the ditched portion of Prairie du Pont Creek enters the Mississippi River. The pair apparently was scared off the site. The next year the pair returned to the island, but no monitoring was conducted to determine if they successfully nested. During the late July 1996 survey we did not observe any eagles in the study area. Remains of a large stick nest were observed at the southern tip of Arsenal Island, but it did not appear to have been used during 1996. We will also check the State of Missouri files for State Designated Endangered or Threatened Species.

Portions of the area suitable for eagle foraging include waterbodies large enough to support large fish such as carp and catfish. The Mississippi River, the channelized section of Prairie du Pont Creek, and a borrow pond at the lower end of Dead Creek all appear to support large fish and provide enough open water for eagles to fish. No foraging eagles were observed during the site visit, nor have local people in the area seen eagles in the vicinity.

Habitat Known to be Used by State Designated Endangered or Threatened Species

The Illinois Natural Heritage Inventory did not have any records of state-listed endangered or threatened species in the study area. However a number of state-listed wading birds were observed throughout the wetlands and waterways. Illinois endangered species observed were little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*)[1], and black-crowned night heron (*Nycticorax nycticorax*). Great egret (*Casmerodius albus*), an Illinois threatened species, was also observed. Small numbers (one to ten individuals) of these wading birds were found foraging along sections of Dead Creek, the ditched length of Prairie du Pont Creek, Cahokia Chute, and the Mississippi River. The largest concentrations of foraging herons (approximately ten individuals at a location) were observed at the confluence of Dead Creek and the ditched Prairie du Pont Creek, and where the ditched Prairie du Pont flows into the Mississippi. These areas likely support the best concentrated fishing areas for wildlife along the waterways.

No wading bird colonies were located within the study area. However, the Illinois Natural Heritage Inventory has documented two 1000-2000 nest mixed-species colonies in East St. Louis. The closest of these two colonies is approximately one mile east of the Monsanto plant near the Alton & Southern rail yards in Alorton. The second site is over two miles to the north at Audubon Avenue and 26th Street. These two colonies contain the only breeding little blue heron and snowy egret in Illinois. In addition, black-crowned night heron, great egret, cattle egret (*Bubulcus ibis*), great blue heron (*Ardea herodias*), and green-backed heron (*Butorides virescens*) nest in the colonies.

In 1988, because the region is heavily industrialized with numerous Superfund sites, the U.S. Fish & Wildlife Service (USFWS) collected black-crowned night heron and little blue heron eggs from the Alorton colony for contaminant analysis (Young, 1989 - unpublished draft). Sediment samples were also taken in areas of observed wading bird foraging around the East St. Louis region. No testing was done of sediments in the Dead Creek drainage. PCB's, DDE, and metals were detected at varying levels from the wading bird eggs.

The observed endangered and threatened wading birds forage on a wide range of aquatic organisms, such as fish, frogs, and crayfish, as well as some terrestrial species such as reptiles and insects. The USFWS study found that wading birds forage over a wide area around East St. Louis. The Dead Creek/Prairie du Pont wetlands system composes a relatively small percentage of the available wetland foraging area in the region.

Wetlands

Wetlands in the study area consist of riparian woods, shrub swamp, marsh, and wet meadow located adjacent to the area's waterways. Drainage from much of the industrial area at the head of Dead Creek is routed away from the Dead Creek drainage via the local municipal sewer system. Dead Creek begins south of an industrial zone adjacent to the Cerro property and flows slowly south through residential neighborhoods. The stream is bordered by a dense, narrow band of riparian trees and shrubs, including cottonwood, willow, mulberry, and box elder (Photo B-1). Homeowners have cleared to the creek's edge and have established lawn along several sections. Within the residential area (east of Route 3) the stream is crossed, via

[1] Also endangered in Missouri.

culverts, by seven roads. At the Judith Lane road crossing, the road culvert has been set approximately one foot higher than the observed water level, apparently to allow drainage of the channel only during high-water events. The pooled channel behind this road is connected to a small pond located at the end of Walnut Street where herons, painted turtle, wood duck, fish, and evidence of beaver (chewed trees, see Photo B-2) were observed (see Table B-1).

Downstream of the impounded channel, Dead Creek segments C and D flow south through bordering wetlands (Photo B-3, note Green Backed Heron in center of photograph). For a short section, adjacent to Parks College, the creek is routed through a culvert under a parking area. Throughout the rest of the creek's length it is bordered by either riparian vegetation (Photo B-4) or lawn (Photo B-5). Emergent and aquatic vegetation occurs along the creek's shores. Wildlife observed in and adjacent to the stream included herons, turtles, songbirds, squirrel, and raccoon. Small fish and frogs were observed throughout the creek's length.

West of Route 3, the creek flows south and west through the American Bottoms floodplain. This area contains active and abandoned agricultural land divided by levees and railroad right-of-ways. After crossing Route 3 Dead Creek flows under a railroad right-of-way and is joined by a stream draining land from the north. North of the confluence of these two waterways is a road that cuts SE to NW across the floodplain, connecting Cahokia to Fox Terminal. To the north (upstream) of this road is a gas tank farm and fields. The stream was observed to flow south under the Fox Terminal road and into Dead Creek. A second dry culvert was observed west of the stream crossing in the vicinity of the north end of the Dead Creek borrow pond. This culvert appeared to drain the land north of the Fox Terminal road during high-water events when water from the tank farm and surrounding area becomes impounded behind the roadway.

Downstream of the confluence of the two waterways, Dead Creek flows through riparian woods and shrubs and into a borrow pond. The pond appears to have been excavated during the construction of the local levee system. The United States Geological Survey (USGS) map of the area (Cahokia) indicates that the pond was dug to its current shape sometime after 1954. The pond is the largest non-flowing water body in the area. Its shore is surrounded with mature riparian trees and emergent wetland vegetation. Ducks, herons, and fish were observed in the pond.

Dead Creek forms the outlet of the pond, draining south through a pump station under the levee (Photo B-6) and into the ditched section of Prairie du Pont Creek. At the confluence and above it (Photo B-7) the ditch shore is vegetated with grasses, herbs, and small shrubs. The channel flows northwest to Arsenal Island on the Mississippi River. Arsenal Island contains areas of mature riparian woods and agricultural fields. The shoreline of the lower end of the ditch (referred to on the USGS map as Cahokia Chute) is lined with riparian woods, principally large cottonwoods and willow (Photo B-8). Large catfish, wood duck, wading birds, and turtles were observed in the channel. Cahokia Chute forms the eastern border of Arsenal Island. The waterway flows north to south, draining the region northeast of the island. It appears that during times when the Mississippi River is high, the River uses the Chute channel to flow around Arsenal Island. Any water from the Dead Creek watershed therefore only flows through the lower half of the Cahokia Chute between the confluence with the ditched Prairie du Pont and the Mississippi River. The remains of the bald eagle nest and congregating wading birds were observed at the southern tip of Arsenal Island, where the Chute flows into the Mississippi.

Almost the entire length of the Dead Creek study area is bordered by wetlands. Most of the wetlands are confined to a narrow riparian strip adjacent to the Creek. More extensive wetlands occur west of Route 3, particularly in the vicinity of the borrow pond. The Creek's wetlands appeared healthy with no evidence of ecological stress (no chlorotic plants, no nonspecific stands of vegetation, no areas of dying or dead vegetation, observable presence of diverse pelagic communities in the stream, no observed surface water sheens or sediment staining). The wetlands also appeared to support a diverse aquatic and terrestrial wildlife community, with abundant prey species (i.e. fish, frogs, turtles) and predatory species (i.e. wading birds, waterfowl, raccoons) present. The wetlands west of Route 3 receive water from both Dead Creek and from drainages to the north, including the area around the gas tank farm.

Summary

During the field survey and subsequent contact with state and federal agencies, three categories of sensitive environments were located in the Monsanto/Dead Creek area: Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened Species, Habitat Known to be Used by State Designated Endangered or Threatened Species, and Wetlands. These three categories are interrelated with the rare species documented all utilizing wetland/waterway habitats. The rare species observed forage over a wide area, with the Dead Creek watershed forming only a small part of their available feeding territory.

The Dead Creek watershed also appears to support a diverse plant and animal community. While much of the Creek flows through residential neighborhoods, sufficient natural riparian vegetation remains to support local aquatic and terrestrial communities. No evidence of ecological stress was evident in the upper Creek, nor anywhere else along the waterway's path to the Mississippi.

2.2 Site Conceptual Model

The foundation of an ERA work plan is the site conceptual model. It integrates information from the preliminary observations at the site (usually incorporated into the screening level risk assessment). According to EPA guidance, the conceptual model addresses:

environmental setting and contaminants known or suspected to exist at the site;

contaminant fate and transport mechanisms;

mechanisms of ecotoxicity and likely categories of potentially affected receptors;

complete exposure pathways.

Figure 1C-1 provides a Preliminary Conceptual Model diagram. It illustrates potential contaminant transport from the contaminated media through the potentially affected habitats to important ecological receptors. We will revisit and, if necessary, amend this model after completion of the site reconnaissance survey.

The site conceptual model is consistent with our knowledge of the area to date as described in our 1996 survey and in the recent EPA Preliminary Risk Assessment.

Environmental Setting and Contaminants Known Or Suspected To Exist At The Site

Subsection 2.1 describes the environmental setting. The EPA Preliminary Ecological Risk Assessment describes the contaminants known or suspected to be at the site. The environmental setting is an aquatic environment with extensive wetlands, riparian woods, narrow, shallow streams, broader semi-impounded basins, and floodplain.

The likely contaminants include those addressed in the EPA assessment:

metals (arsenic, barium, cadmium, chromium, lead, mercury);

PCBs;

PAHs;

dioxin.

The eventual execution of the QAPP/FSP will analyze for a broader list of potential contaminants in sediments, surface water, and biota. We will evaluate those data within the baseline risk assessment and add contaminants as appropriate based on: frequency of occurrence within a particular media, likely bioavailabilty, evidence for bioaccumulation, toxicity to likely receptors, and comparison of concentrations to a reference area. Obviously, the addition of more contaminants of concern may require changes in the conceptual model for the baseline risk assessment depending upon the fate, transport, and biological properties of these contaminants. The EPA guidance recognizes and encourages this iterative process.

Contaminant Fate and Transport Mechanisms

In an aquatic system such as occurs over Dead Creek Sectors B through F, and M, various physical, chemical, and biological transport mechanisms will affect the fate of contaminants. All the contaminants listed in the EPA Preliminary Assessment adhere to particulate matter to varying degrees. Therefore, the conceptual model should address those mechanism affecting particle distribution in aquatic systems. These include:

particulate runoff from the watershed,

deposition in areas of sluggishly flowing waters,

erosion in faster moving stream segments, and

resuspension of particulates from the stream bed and over the floodplain.

Chemicals with lower particle affinities may be more subject to dissolution in and transport by surface water. Increasing solubility generally correlates with increasing bioavailability. In particular, various metals on the preliminary list of contaminants are subject to transport in soluble form, depending on their valence states.

The major biological mechanisms affecting fate and transport are:

biological uptake directly from environmental media; and,

bioaccumulation through ingestion of prey or media;

biomagnification through the food chain.

Several of the contaminants are subject to one or all of these biological fate and transport mechanisms.

The baseline risk assessment will describe each contaminant of concern (including any added after the next sampling rounds) in terms of the transport mechanisms most likely to affect it. The EPA Preliminary Risk Assessment provides a description of the likely transport mechanisms for each of the contaminants or classes of contaminants listed.

Mechanisms of Ecotoxicity And Likely Categories Of Potentially Affected Receptors

The EPA Preliminary Risk Assessment summarizes the ecotoxicological properties of the potential contaminants in sufficient detail to develop the first iteration of the conceptual model. As indicated in the summaries, the various contaminants may affect the survival and reproductive capacity of benthic biota, fish, invertebrates, vascular plants, and algae.

The baseline risk assessment will provide detailed ecotoxicity profiles for the final list of contaminants of concern. These will include summaries of the toxicity of these chemicals to receptors likely to occur in the Dead Creek environment (insofar as these exist), and a selection of the most appropriate toxicity factor to use in the baseline risk assessment.

The categories of likely potentially affected receptors for an aquatic system such as the Dead Creek, Sectors B through F, and M include:

The benthic macroinvertebrate community;

warm water fish (e.g., largemouth bass);

waterfowl (e.g. mallard) that feed on plants and macroinvertebrates (including crayfish);

piscivorous birds (e.g., great blue heron, bald eagle);

aquatic mammals (e.g. muskrat) that feed on plants and macroinvertebrates (including crayfish);

aquatic mammals (e.g., river otter or racoon) that feed on fish and macroinvertebrates (including crayfish).

There is also some potential for exposure to terrestrial plants and wildlife from exposure to contaminants in soil or through exposure to soil based food chains.

Complete Exposure Pathways

The USEPA guidance indicates that the risk assessment must identify complete exposure pathways before a quantitative evaluation of toxicity to allow the assessment to focus on those contaminants that can reach ecological receptors. The likely complete exposure pathways in Dead Creek, Sectors B through F, and M are:

sediment to benthic invertebrates via direct contact and ingestion;

sediment and surface water to aquatic plants via uptake;

surface water to invertebrates and fish though direct contact and ingestion;

benthic biota (including crayfish) to higher order predators (e.g. fish) through food chain;

forage fish and crayfish to piscivorous fish, mammals, or birds;

soil to soil invertebrates along the creek banks or floodplain;

soil to plants or wildlife along the creek banks or floodplain.

3.0 SELECTION OF CHEMICALS OF ECOLOGICAL CONCERN (COECs)

As indicated in subsection 2.2, the USEPA Preliminary Risk Assessment provides an initial list of contaminants of ecological concern (COECs). The QAPP/FSP includes target analytes beyond these initial COECs. These target analytes include: VOCs, metals, SVOCs, PCBs, and pesticides.

The baseline risk assessment will re-evaluate the COEC list based in the results of the proposed sampling and analysis of surface water, sediment, and biota. The criteria for final selection include:

> Comparison to Background – the baseline risk assessment will eliminate a contaminants which occurs below the maximum concentration measured at a local reference area for a given medium;
>
> Frequency of Detection – the baseline risk assessment will retain a contaminant detected in more than 5% of samples for a particular media.

For those compounds which exceed background and/or are frequently detected in a particular medium, the baseline risk assessment will add them to the final list of COECs if they exhibit any of the following characteristics:

> Toxic – exhibit toxicity (based on scientific literature) to the receptors likely to occur along the Dead Creek, Sectors B through F and M, or adjacent habitats;
>
> Bioaccumulative – are likely to bioconcentrate or biomagnify through the food chains represented in Dead Creek, Sectors B through F, and M, and adjacent habitats;
>
> Persistent – are likely to remain in environmental media over time frames that are long relative to the life spans or exposure periods of receptors likely to occur in Dead Creek, Sectors B through F, and M, and adjacent habitats.

The ERA will include a current review of toxicological information for all COECs on the final list. Where available, this information will include toxicity benchmarks that are applicable to water and sediments.

4.0 IDENTIFICATION OF RECEPTORS, ASSESSMENT ENDPOINTS, AND MEASURES OF EFFECT

4.1 Receptors

This subsection of the ecological risk assessment identifies the receptors (receptor species) and provides the rationale for their selection as representative of the species that occur or are likely to occur near the site. This subsection also provides an ecological characterization of each receptor for eventual use in developing the exposure assessment.

The selected receptors represent those types of organisms most likely to encounter the contaminants of concern at the site. They include a reasonable (although not comprehensive) cross-section of the major functional and structural components of the ecosystem under study based on:

relative abundance and ecological importance within the selected habitats;

availability and quality of applicable toxicological literature;

relative sensitivity to the contaminants of concern;

trophic status;

relative mobility and local feeding ranges;

ability to bioaccumulate contaminants of concern.

The selected species represent different feeding guilds. This representative species approach for assessing exposures for wildlife is a common practice for assessing risk. A guild is a group of animals within a habitat that use resources in the same way. Coexisting members of guilds are similar in terms of their habitat requirements, dietary habits, and functional relationships with other species in the habitat. Guilds may be organized into potential receptor groups. The use of the guild approach allows focused integration of many variables related to potential exposure. These variables include characteristics of COECs (toxicity, bioaccumulation, and mode of action), and characteristics of potential receptors (habitat, range and feeding requirements, and relationships between species). This approach evaluates potential exposures to all animals by considering the major feeding guilds found in a habitat. It is assumed that evaluation of the potential effects of COECs to the representative species will be indicative of the potential effects of COECs to individual member classes of organisms within each feeding guild.

The selected species represent the ecological community and its sensitivity to the contaminants of concern. They are: benthic invertebrates, shellfish, local fin fish, great blue heron, mallard, bald eagle, muskrat, and river otter or raccoon.

Benthic invertebrates

Benthic invertebrates are potential receptor species in Dead Creek because they:

have the greatest exposure to sediments;

provide food for bottom-feeding fish species (in the river);

are relatively immobile (sessile) in habit, and therefore their general health and condition reflects local conditions;

Warm Water Fish Species

Warm water resident fish species were selected to reflect local sediment and water quality conditions. The typical warm water fish species such as centrachids (sunfish, bass) and bottom feeding fish such as bullheads are likely and abundant local resident with a limited foraging range. These organisms are potential receptor species representing local fish because they are:

resident in this reach of the Dead Creek;

exposed to sediments as well as surface water;

represent forage fish and higher order predators feeding on smaller fish and invertebrates.

Aquatic Birds

We have selected great blue heron, mallard duck, and bald eagle to represent aquatic birds feeding in Dead Creek, Sectors B through F, and M for at least a portion of the time.

Great Blue Heron (*Ardea herodias*)

The great blue heron inhabits salt and freshwater environments, typically shallow waters and shores of lakes, flooded gravel pits, marshes and oceans. In marsh environments, the great blue heron is an opportunistic feeder; they prefer fish, but they will also eat amphibians, reptiles, crustaceans, insects, birds, and mammals. The diet varies but may include up to 100% fish. A Nova Scotia study found 6% forage fish (Atlantic silverside and mummichog), 52.6% eels, and 41.4% other fish in the diet of great blue heron (USEPA, 1993). A food ingestion rate for adult breeding birds of 0.18 g food/g body weight/day has been reported.

Great blue heron tend to forage near nesting sites (USEPA, 1993). A study in Minnesota measured the distance between nesting and foraging grounds to range from 0 to 2.7 miles. A Carolina study found the same distance to be 4 to 5 miles. The maximum distance great blue heron will fly between foraging areas is 9 to 13 miles (USEPA, 1993). The size of the feeding territory in a freshwater area in Oregon was 1.5 acres, while the feeding territory in an estuarine area was 21 acres.

These organisms are potential receptor species because they:

Consume near shore fish;

Have a foraging range about equal to the downstream area of the Dead Creek sectors;

Are a higher trophic level predator in the creek and Mississippi.

Great blue heron, therefore, represent piscivorous birds in this reach of the river.

Mallard (*Anas platyrhynchos*)

The mallard is the most common freshwater duck of the United States, found on lakes, rivers, ponds, etc. It is a dabbling duck, and feeds (usually in shallow water) by "tipping up" and eating food off the bottom of the water body. Primarily, it consumes aquatic plants and seeds (for instance, primrose willow and bulrush seeds), but it will also eat aquatic insects, other aquatic invertebrates, snails and other molluscs, tadpoles, fishes, and fish eggs. Ducklings and breeding females consume mostly aquatic invertebrates. The mallard's home range is variable, but an approximate range is 500 hectares. It prefers to nest on ground sheltered by dense grass-like vegetation, near the water.

Mallards are a potential receptor species because they:

Consume both aquatic plants and aquatic invertebrates;

Live on or near the water;

Are a lower trophic level duck in the creek and in Mississippi.

Mallards, therefore, represent waterfowl in this reach of the river.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are generally found in coastal areas, near lakes or rivers. Their preferred breeding sites are in large trees near open water. They are usually found in areas with minimal human activity.

Bald eagles, although primarily carrion feeders, are opportunistic and will eat whatever is plentiful including fish, birds, and mammals. Reported food ingestion rates range from 0.064 to 0.14 g/g/day. A study of adult breeding bald eagles in Connecticut estimated a food ingestion rate of 0.12 g/g/day (USEPA, 1993). A study of bald eagle diets in Maine indicated that their diets consisted of 76.7% fish, 16.5% birds, and 6.8% mammals (USEPA, 1993).

Foraging areas vary according to season and location. The USEPA (1993) reports a foraging length of 2 to 4.5 miles along a river.

These organisms are potential receptor species because they:

Consume fish;

Are a higher trophic level predator in the river;

Are sensitive to contaminants that biomagnify in the food chain.

The bald eagle, therefore, represents predatory birds in these sectors of Dead Creek.

Aquatic Mammals

This assessment assumes that either river otter (or racoon if the site reconnaissance indicates that otter are unlikely to occur in the area) and muskrat represent aquatic mammals in Dead Creek sectors B through F.

River Otter (*Lutra canadensis*)

The river otter can be found in primarily freshwater but also saltwater environments, but seems to prefer flowing-water habitats rather than still water. It has been found in lakes, marshes, streams, and seashores. It consumes largely fish, but is opportunistic and will consume aquatic invertebrates (crabs, crayfish, etc.), aquatic insects, amphibians, birds (e.g. ducks), small or young mammals, and turtles. They may also sift through sediment for food. The otter dens in banks, in hollow logs, or similar burrow-like places. Home range varies depending on habitat and sex, but an approximate measure is 300 hectares.

River otters are a potential receptor species because they:

Consume fish and aquatic invertebrates;

Live in or near the water;

Are a higher trophic level predator in the creek and in Mississippi.

River otters, therefore, represent higher trophic level aquatic mammals in this reach of the river.

Raccoon (*Procyon lotor*)

The raccoon is likely to be present because the creek and surrounding areas consist of its most preferred types of habitat (marshes and suburban residential areas). Because the raccoon is an omnivore, it is likely to experience greater exposure to than the muskrat which is primarily a herbivore. The raccoon is known to consume aquatic invertebrates (such as crayfish), fish, insects, mollusks, annelids, bird eggs, small passerine birds, small mammals such as squirrels, and plants (Chapman and Feldhamer, 1990).

Raccoon are a potential receptor species because they:

Consume fish and aquatic invertebrates;

Live near the water;

Are a higher trophic level predator in the creek and in Mississippi.

Raccoon, therefore, represent higher trophic level aquatic mammals in this reach of the river.

Muskrat (*Ondatra zibethicus*)

The muskrat is a semiaquatic large rodent which lives near freshwater and brackish aquatic environments: marshes, ponds, creeks, lakes, etc. It feeds largely on aquatic plants, but depending on location and time of year may also consume aquatic invertebrates (crayfish, crabs, etc.), small amphibians, turtles, fish, molluscs, and even young birds. The muskrat lives quite close to the water, either on the bank of the water body or constructing a lodge in the water body. Its home range is small (0.17 hectares on average) and one study found that muskrats remain within 15 meters of their primary dwellings 50 percent of the time.

Muskrats are a potential receptor species because they:

Consume aquatic plants and aquatic invertebrates;

Live on or near the water;

Are a lower trophic level omnivore in the creek and in Mississippi.

Muskrats, therefore, represent lower trophic level aquatic mammals in this reach of the river.

Soil invertebrates

Soil invertebrates are potential receptor species in Dead Creek banks and floodplain because they:

have the greatest exposure to soil;

provide food for birds and mammals (in the river);

are relatively immobile (sessile) in habit, and therefore their general health and condition reflects local conditions;

4.2 Assessment Endpoints

Assessment endpoints are expressions of the environmental value to be protected at a site. Assessment endpoints are often not directly measurable. Therefore, assessment employs measures of effects. These are biological or measurable ecological characteristics which reflect the assessment endpoint (USEPA, 1997). Where the assessment endpoint is not directly measurable, the use of a measure of effect may result in some uncertainty in the risk characterization. Ultimately, the selection of assessment endpoints requires the consensus of the regulators, the regulated community, and state or local concerns. This work plan proposes the following assessment endpoints for the potentially-affected aquatic receptors and their habitats:

Sustainability (survival, growth, and reproduction) of warm water fish species typical of those found in similar habitats (incorporates the assessment of benthic macroinvertebrates and crayfish);

Survival, growth, and reproduction of local populations of aquatic wildlife represented by bald eagles, mallard duck, great blue heron, muskrat, and river otter or raccoon (incorporates the assessment of benthic macroinvertebrates and crayfish).

The assessment will evaluate risk relative to these assessment endpoints in Creek, Sectors B through F and M, collectively and individually, based on prior observations and the work proposed in the QAPP/FSP.

4.3 Selection of Measures of Effects

The measures of effect direct data collection needs for the baseline ecological risk assessment. They provide the actual measurements for estimating risk. A weight-of-evidence approach (Menzie et al., 1996) weighs each of the measures of effects by considering:

strength of association between the measure of effects and assessment endpoint;

data quality; and

study design and execution.

Strength of association refers to how well a measure of effects represents an assessment endpoint. The greater the strength of association between the measurement and assessment endpoint, the greater the weight given to that measure of effect in the risk analysis.

The weight given a measure of effect also depends on the quality of the data as well as the overall study design and execution. The QAPP/FSP describes a sampling program that will provide information adequate for evaluating each selected measure. However, the risk assessment must evaluate the performance of the sampling effort and the variability and uncertainties associated with the results following implementation. The risk characterization gives higher weight to measures of effect that are based on good quality data and are obtained using study designs that account for confounding variables.

There is considerable uncertainty associated with estimating risks, because ecological systems are complex and exhibit high natural variability. Measures of effects typically have specific strengths and weaknesses related to the factors discussed above. Therefore, it is common practice to use more than one measure of effect to evaluate each assessment endpoint. This subsection describes the measures of effects and how the baseline risk assessment will use them to evaluate risks for each of the assessment endpoints.

TABLE 1
ASSESSMENT ENDPOINTS
AND ASSOCIATED MEASURES OF EFFECTS

Assessment Endpoint 1: Sustainability of warm water fish in Creek Sector F

Measure of effect 1a: body burdens of COECs in selected fish species as a measure of exposure (compared to body burdens in fish from reference areas) and effects (compared to benchmark values).

Measure of effect 1b: COEC concentrations in surface waters as compared to applicable water quality criteria for protection of fish and wildlife.

Measure of effect 1c: sustainability of a benthic macroinvertebrate community that can serve as a prey base for fish:

Concentration of COECs in sediment;

Field assessment of benthic macroinvertebrate community structure (using EPA Rapid Bioassessment Protocol I, as described in *Rapid Bioassessment Protocols for Use in Streams and Rivers, Benthic Macroinvertebrates and Fish*, EPA/444/4-89-001.

Sediment toxicity tests.

Assessment Endpoint 2: Survival, growth, and reproduction of local populations of aquatic wildlife as represented by the bald eagle, mallard duck, great blue heron, muskrat, and river otter or raccoon in Creek Sectors B through F, and M

Measure of effect 2a: Wildlife species composition and habitat use.

Measure of effect 2b: Concentration of semi-volatile compounds (SVOCs), metals, mercury, Polychlorinated Biphenyls (PCBs), pesticides, cyanide, herbicides, and dioxin in aquatic and marsh plants for use in evaluating exposure via the food chains for mallard duck, river otter or raccoon , and muskrat.

Measure of effect 2c: Concentration of COECs in surface waters in comparison to wildlife benchmarks.

Measure of effect 2d: Concentration of COECs in forage fish and crayfish for use in evaluating exposure via the food chain for great blue heron and river otter or raccoon.

Measure of effect 2e: Concentration of SVOCs, metals, mercury, PCBs, pesticides, cyanide, herbicides, and dioxin in macroinvertebrates (including crayfish) for use in evaluating exposure via the food chain for mallard duck, river otter or raccoon and muskrat.

Measure of effect 2f: sustainability of a benthic macroinvertebrate community that can serve as a prey base for fish (includes three lines of evidence as in Assessment Endpoint 1).

Assessment Endpoint 3: Survival, growth, and reproduction of individuals within the local bald eagle population in Creek Sectors B through F, and M

Measure of effect 3a: Concentration of COECs in fish for use in evaluating exposure via the food chain.

Assessment Endpoint 4: Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Creek Sectors B through F, and M

Measure of effect 4a: Soil screening effect levels for the protection of wildlife, plants, and soil dwelling invertebrates.

4.3.1 Measures of Effects for Assessment Endpoint 1, Sustainability of Warm Water Fish

The COECs may exert direct effects on warm water fish through exposure in the water, sediment, or prey, and indirectly by affecting their prey, the macroinvertebrate community. The proposed measures of effects assess exposure pathways and potential effects. Some rely upon direct observations of conditions; some involve measures of toxicity; and others use literature values.

Measure of effect 1a: body burdens of COECs in selected fish species.

Purpose and Rationale. Fish exposed to bioaccumulative compounds in their diet or in water can accumulate these COECs in their tissues. Contaminants tend to accumulate in organs such as the liver and kidney to a greater degree than in the musculature. However, COEC levels in the muscle tissue and on a whole body basis are useful for evaluating risks to animals that eat fish. The assessment will use measurements of COECs in fish tissues to evaluate exposure and effects on the fish, and to provide data for use in other parts of the assessment.

Approach. The assessment will use this endpoint to evaluate exposure and effects. As a measure of exposure, it will compare body burdens of COECs in small forage fish, medium bottom-feeding fish and large piscivorous fish to those same fish species in the reference area. Therefore, the comparisons of fish body will help to assess if fish in Dead Creek are exposed to COECs in excess of those that occur in the reference area. The assessment will also use the body burden data as input to the food chain exposure models for the representative piscivores (the great blue heron, bald eagle, and the river otter or raccoon).

As a measure of effects, the assessment will compare measured body burdens to literature values at which effects have been reported. The Waterways Experiment Station (WES) of the Army Corps of Engineers provides an on-line database and The Society of Environmental Toxicology and Chemistry (Jarvinen and Ankley, 1999) provides a compilation of such residue effect levels. The assessment will query these databases. If body burdens exceed levels at which effects have been reported in the databases, it will be presumed that the measure of effect indicates the potential for effects in the selected fish species found in Dead

Creek.

Measure of effect 1b: COEC concentrations in surface waters as compared to applicable water quality criteria for protection of fish and wildlife.

Purpose and Rationale. Water concentrations provide a measure of exposure, and water quality criteria indicate levels above which effects may occur. This measure of effect will evaluate the potential for water concentrations of COECs in Dead Creek to cause adverse effects.

Approach: The assessment will compare measured concentrations of dissolved metals in surface waters to water quality criteria. Exposure of individual fish and the populations of fish in water will partly depend on the exposure field and the distribution and behavior of the fish. Thus, the area over which water quality criteria are exceeded becomes an important consideration when evaluating exposure. We will evaluate effects with respect to spatial extent and degree to which surface water concentrations exceed water quality criteria.

The USEPA has published an ECO-UPDATE entitled: "Ecotox Thresholds" that includes COEC-specific water quality benchmarks. If an Ecotox Threshold value is available for a COEC, the concentration of the COEC in water will be compared to its respective Ecotox Threshold value. When specific benchmarks are not available and when appropriate, USEPA has suggested using appropriate extrapolations between related species.

Measure of effect 1c: Sustainability of benthic macroinvertebrate communities that comprise a prey base

Purpose and Rationale. Benthic macroinvertebrates are an important source of food for many fish species. They experience direct sediment exposures due to their life histories. Exposures that result in reduced abundance, diversity, or biomass of these aquatic macroinvertebrates, could indirectly effect fish populations. Further, quantitative studies of benthic macroinvertebrates have a long history of use in water quality studies.

The assessment will use the sediment triad approach as part of a weight-of-evidence analysis to evaluate the sustainability of benthic macroinvertebrate communities in these water bodies. The sediment triad approach evaluates three elements of a benthic community:

field assessment of benthic macroinvertebrates;

sediment chemistry measurements;

sediment toxicity testing using indicator benthic macroinvertebrates.

Field assessment of benthic macroinvertebrate community

Effects will be evaluated by comparing the composition and abundance of benthic macroinvertebrates within Dead Creek at different levels of concentrations of COECs in sediments (generally following EPA Rapid Bioassessment Level I Protocols in the field). These comparisons will help to estimate if there is a level above which effects are evident. Data from the reference areas will help to support the assessment because these reflect conditions in water bodies unaffected by site contaminants. If there are observable reductions in the abundance of benthic macroinvertebrates, we will assess the significance of this for the fish species that rely upon the macroinvertebrates for food as this is the basis for the assessment. This will be accomplished by relating the abundance and biomass of benthic macroinvertebrates to their production, and ultimately to the potential production of fish, using available production:biomass ratios from the literature.

Sediment chemical measurements

Concentrations of COECs in sediment will be compared to sediment benchmarks to judge whether adverse biological effects to benthic macroinvertebrates are plausible. The USEPA compares sediment chemical measurements to Effect Range-Low (ERL) values and Effect Range-Median (ERM) values (Long and Morgan, 1990). However, sediment concentrations which exceed ER-Ls and/or ER-Ms do not necessary indicate that adverse effects to benthic macroinvertebrates have occurred. The USEPA's sediment triad approach uses multiple lines of evidence to assess if benthic macroinvertebrates are adversely affected by sediment-associated contaminants.

The USEPA has published an ECO-UPDATE entitled: "Ecotox Thresholds" that includes COEC-specific sediment benchmarks. If an Ecotox Threshold value is available for a COEC, the concentration of the COEC in sediment will be compared its respective Ecotox Threshold value. When specific benchmarks are not available and when appropriate, USEPA has suggested that appropriate extrapolations between related species can be used.

Sediment toxicity testing

The assessment will use laboratory sediment bioassays conducted on sediments from Dead Creek and the reference area to evaluate the potential effects of whole sediment on representative benthic macroinvertebrates. The toxicity of the sediment will be compared to that of the standard control sediment used by the laboratory as part of the laboratory's standard operating procedures. Statistically significant decreases in survival and/or growth relative to controls will be considered a COEC-related effect when they can be related to exposures associated with COECs in the sediments.

4.3.2 Measures of Effects Associated with Assessment Endpoint 2

Survival, growth, and reproduction of local populations of aquatic wildlife populations represented by bald eagles, mallard duck, great blue heron, muskrat, and river otter or racoon (incorporates the assessment of benthic macroinvertebrates)

The assessment will use six measures of effects (some species-specific) to evaluate risks to the wildlife assessment endpoint. Food-chain modeling will estimate exposure to the four wildlife species.

Wildlife either sighted during prior site visits or likely to occur based on the evaluation of habitats was used to identify representative wildlife species.

Table 2. Representative Aquatic Wildlife Species Proposed for Assessing Risks of COECs to Wildlife.

Species	Feeding Guild	Primary Habitat	Use in ERA
Bald Eagle	Eats fish and other small animals	Aquatic	Evaluate exposure to COECs in aquatic food webs
Great Blue Heron	Eats fish and other small animals	Aquatic	Evaluate exposure to COECs in aquatic food webs
Mallard Duck	Eats plants and macroinvertebrates	Aquatic	Evaluate exposure to COECs in aquatic plants and macroinvertebrates
Muskrat	Eats plants and some macroinvertebrates (e.g., clams)	Aquatic	Evaluate exposure to COECs in aquatic plants and in macroinvertebrates
River otter or raccoon	Eats fish, other small animals and some macroinvertebrates	Aquatic	Evaluate exposures to COECs in fish and macroinvertebrates

The assessment will use exposure models to evaluate different routes of exposure including ingestion of water, sediment and food (plants, benthic macroinvertebrates and fish). This subsection describes the measures of effects and the general model used to evaluate exposures.

Measure of effect 2a: Wildlife species composition and habitat use.

Purpose and Rationale. The measure of effect directly examines the receptors – wildlife – to estimate if they are using the various sectors of Dead Creek. The assessment is a measure of the degree to which local and migratory wildlife use the habitat and the extent to which it supports their needs.

Approach: The assessment will compare the composition and habitat use by wildlife to observations of species composition of wildlife and their use of a reference area. A wildlife biologist will make these observations This type of survey is qualitative. The strength of the analysis is that it indicates whether Dead Creek can support wildlife species comparable to unaffected reference areas. However, because of the qualitative nature of the observations and the high natural variability that can exist in wildlife populations, direct observations may not reveal effects.

Measure of effect 2b: Concentrations of COECs in aquatic and marsh plants.

This measure of effect will be conducted within Dead Creek Segments B to F, and M and the reference areas.

This plan recommends collecting aquatic and marsh plants for analysis of COECs because some species of wildlife using Dead Creek and wetlands eat aquatic and marsh plants. This is a potentially complete exposure pathway for wildlife. The QAPP/FSP describes the details of the aquatic and marsh plant collection and analysis.

Purpose and Rationale. The assessment will compare measures of COECs in submerged aquatic and emergent marsh vegetation within Dead Creek and a reference water body. Waterfowl graze on aquatic plants. Herbivorous mammals such as the muskrat eat aquatic and emergent vegetation in wetlands. If plants take up metals and PAHs from the water or sediments, waterfowl and herbivorous mammals could be exposed to these COECs in their diet.

As the QAPP/FSP indicates, fruiting bodies/leaves and roots from aquatic plants and emergent plants will be composited separately.

Approach: The endpoint will be evaluated in multi-pathway exposure models for the mallard and the muskrat that considers sediment, water, and food. Exposures to water fowl and herbivorous mammals within the Dead Creek sectors will be compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas. The COEC concentrations measured in submergent aquatic plants will be used to evaluate potential dietary exposures to the mallard, which graze on aquatic plants. The COEC concentrations measured in submergent and emergent plants will be used to evaluate potential dietary exposures to the muskrat, which graze on greens.

Measure of effect 2c: Concentration of COECs in surface waters.

Purpose and Rationale. Many wildlife species will use Dead Creek and associated wetlands as a drinking water source. The presence of COECs in water could be a source of exposure to these species. This measure of effect examines this potential route of exposure.

Approach: This endpoint will be evaluated in multi-pathway exposure models for the mallard and the great blue heron that considers sediment, water, and food. The assessment will compare exposures to these selected representative species within the Dead Creek sectors to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

Measure of effect 2d: Concentration of COECs in fish.

Purpose and Rationale: Some wildlife species such as the bald eagle, the great blue heron eat primarily fish. This measure of effect evaluates this potential route of exposure.

Approach. Fish will be collected and analyzed for COECs. The COEC levels measured in fish will be used in the multi-pathway exposure model for the bald eagle and the great blue heron that considers sediment, water, and food. Exposures to the bald eagle and the great blue heron within the Dead Creek Sectors will be compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

Measure of effect 2e: Concentration of metals and PAHs in benthic macroinvertebrates (including crayfish).

Purpose and Rationale. Waterfowl (such as the mallard) and mammals (such as the muskrat) eat benthic macroinvertebrates as a portion of their diet. This measure of effect evaluates this potential route of exposure.

Approach: Benthic macroinvertebrates and crayfish will be collected and analyzed for COECs. The COEC levels measured in benthic macroinvertebrates will be used in a multi-pathway exposure model for the mallard and for the muskrat that considers sediment, water, and food. Exposures to water-fowl and mammals within the Dead Creek Sectors will be compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

4.3.3 Measures of effects Associated with Assessment Endpoint 3

Assessment Endpoint 3 is survival, growth, and reproduction of individuals within the local bald eagle population in Creek Sectors B through F, and M.

Measure of effect 3a: Concentration of COECs in forage fish for use in evaluating exposure via the food chain.

Purpose and Rationale. Bald eagle may use fish in Dead Creek and associated wetlands as food. The presence of COECs in fish could be a source of exposure to this species. This measure of effect examines this potential route of exposure.

Approach: This endpoint will be evaluated in a an exposure model for the bald eagle. The assessment will compare exposures to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

4.3.4 Measures of Effect Associated with Assessment Endpoint 4

Measure of effect 4a: COEC concentrations in soil samples from Creek bank and floodplain as compared to applicable soil screening levels for protection of wildlife, plants, and soil dwelling invertebrates.

Purpose and Rationale. Soil concentrations provide a measure of exposure, and screening level criteria indicate levels above which effects may occur. This measure of effect will evaluate the potential for soil concentrations of COECs in Dead Creek banks and floodplains to cause adverse effects.

Approach: The assessment will compare measured concentrations of total contaminant concentrations in soils to existing (e.g. Oak Ridge National Laboratory Toxicological Benchmarks for Wildlife; Oak Ridge National Laboratory Toxicological Benchmarks for Screening Potential Effects on Terrestrial Plants; Oak Ridge National Laboratory Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes).

We will also use any terrestrial soil screening concentrations or benchmarks developed by the time the proposed work occurs.

4.4 Structure of Wildlife Exposure Models

The general form of the wildlife exposure model is:

Exposure Dose (oral) = $[Conc_{food} * Ingest_{food}] + [RAF * Conc_{soil} * Sediment_{diet} * Ingest_{food}]$

Where:

Exposure Dose (oral) = dose of a COEC in ug/g-day

$Conc_{food}$ = concentration of the COEC (ug/g) in the food (measured or estimated); this is the average and the 95 % CL concentration in the relevant exposure zone – an area determined by the size and locations of foraging areas. The average is the appropriate statistic because ecological receptors integrate exposure over their foraging areas. We will also use the 95% CL and calculate risk from this exposure separately.

$Ingest_{food}$ = amount of food ingested per day normalized to body weight (g/g-day) and usually expressed in terms of wet weight/wet weight

RAF – relative availability factor for COECs in sediment via incidental ingestion of sediment

$Conc_{sediment}$ = concentration ug/g in the relevant exposure zone; this is estimated as an average concentration in the exposure zone for chronic exposure and effects, and as upper bound (e.g., maximum or hot spot concentrations) for evaluation of short-term or acute exposures. The average is the appropriate statistic because ecological receptors integrate exposure over their foraging areas.

$Sediment_{diet}$ = fraction of sediment in the diet; the product of this number and $Ingest_{food}$ yields an estimate of the amount of sediment that is incidentally ingested

Sediments that are collected within shallow water (< 3 feet deep) in open water areas of Dead Creek, sediments along the bank, and soils adjacent to the creek (where available) will be used to assess incidental sediment ingestion. Sediments collected from the top 5 cm will be considered accessible to aquatic wildlife.

Because exposures to COECs associated with diet and sediment will be higher than surface water ingestion, this exposure pathway will not be estimated within the model. However, we will compare National Recommenced Water Quality Criteria for the protection of wildlife to surface water concentrations where such data and corresponding criteria are available.

Model Application

The model will be applied in several ways:

1. Acute exposure: The potential for acute exposure is considered without incorporating information on foraging area. The rationale for this is that an acute exposure involves a short-term feeding or exposure event that does not have to be averaged over the foraging area. When calculating the potential for acute exposure, maximum concentrations are used within the geographically defined local population or Threatened and Endangered species. Locations that exceed exposure concentrations that could result in acute toxic effects are identified.

2. Chronic exposure to individuals: The potential for chronic exposure to individuals is considered by determining both the maximum concentration and calculating an average concentration of food and sediments at spatial scales defined by the foraging areas of the species. For example, exposure concentrations for a species with a foraging area of 10 ha would be determined by averaging the food and sediments concentrations within this spatial scale. A species with a foraging area of 0.1 ha would have an averaging area that is 100 times less.

3. Chronic exposure to the population. The local population as defined above is made up of a number of individuals. Because the success of the local population is not dependent on the risk to any particular individual, a wildlife exposure model will also be used to estimate chronic exposures to individuals throughout the local population. These estimates take into account the spatial distribution of COECs, the foraging areas of the individuals within the species, and possible spatial distributions of these individuals within the area that defines the local population. Results are used to estimate risks as a percentage of the local population. The local population is confined to individual animals that use Dead Creek and its associated wetlands and small ponds.

4. Acute and chronic exposures to the Bald Eagle. Because the Bald eagle is rare and the risk to the individual is considered, the wildlife exposure model will also be used to estimate exposures to the individual.

5.0 RISK CHARACTERIZATION

Risk results will be presented as calculated Hazard Quotients as well as other measures (e.g., presence of toxicity). These results will be incorporated into the weight of evidence approach in the form of graphs and tables and will be explained in narratives. Graphs will be used to illustrate the four factors that contribute to the weight of evidence evaluation.

5.1 Use of Hazard Quotients

Because the Hazard Quotient will be one of the more common methods used to express results, it is explained below. The method simply involves comparisons of exposure concentrations for COECs to concentrations at which effects are judged:

$$\text{Hazard Quotient} = \frac{\text{Concentration}_{\text{exposure}}}{\text{Concentration}_{\text{effects}}}$$

where:

Concentration $_{\text{exposure}}$ = the concentration or dose to which an organism is exposed

Concentration $_{\text{effects}}$ = the concentration or dose at or above which effects may occur

If the Hazard Quotient exceeds "1", there is a potential for an effect. To some extent, the higher the number above "1", the more likely that an effect would occur. Calculations of Hazard Quotients need to take into account spatial and temporal factors inasmuch as these are related to the effect that might occur to populations of biota. The COECs may have additive effects on organisms, and these will be evaluated by summing across compounds grouped according to the specific toxicological effect they may have.

5.2 Toxicity Reference Values for Wildlife

TRVs used in the toxicity quotient's denominator represent chronic oral No Observed Adverse Effect Levels (NOAELs). A TRV will be expressed as mg of COEC / kg Body Wt. of the test animal / day. TRVs will be selected from published studies cited in the following sources:

> United States Fish and Wildlife Service (USFWS) biological reports that review and summarize literature on the ecological and toxicological aspects of COECs with special reference to fish and wildlife.
>
> Toxicological animal studies cited in: Sample, B.E., D. M. Opresko and G.W. Suter II, 1996, *Toxicological benchmarks for wildlife: 1997 revision*, Oak Ridge National Laboratory, Oak Ridge, Tennessee;

The Waterways Experimental Station on-line database;

The Society of Environmental Toxicology and Chemistry's recently published database of residual effect levels (Jarvinen and Ankley, 1999);

Computer on-line data bases, such as Toxline, Biosis, Wildlife Fisheries Review, Pollution Abstracts, and Environmental Abstracts.

When reviewing the toxicological literature and selecting the most appropriate TRV, several factors will be considered including:

- Taxonomic relationship between the test animal and the indicator species;
- Use of laboratory or domesticated animals;
- Ecological relevance of the study endpoints—Studies with chronic toxicity endpoints, such as reproductive, growth, behavior and developmental endpoints, are targeted. Sensitive endpoints, such as reproductive or developmental toxicity, are preferentially selected because they are closely related to the selected assessment endpoints (*e.g.*, population declines);
- Toxicological studies in which the chemical was administered through the diet of the test species are preferred over studies using other oral dosing methods, such as gavage; and
- Long-term studies representing chronic exposure are preferentially selected.

Dietary concentrations (mg/kg diet) cited in the reference study will be converted to mg/kg BW/day. If the daily dose reported in the selected study is a Lowest Adverse Effect Level (LOAEL), then the LOAEL will be converted to a NOAEL using a factor of 10. Interspecies correlations will be considered.

If toxicological animal studies are not available for a particular COEC, then QSAR will be considered and a surrogate chemical will be selected when possible. If the COEC can not be assessed quantitatively, then the risk to the COEC will be qualitatively discussed.

Species specific toxicity factors may not be available for all COEC. In such cases, the assessment will apply the following sequential steps to develop a toxicity factor.

- Use a toxicity value or criterion for the protection of exposed organisms, if an appropriate state or federal agency has proposed it.

- If criteria are unavailable, but appropriate data are available on NOAELs for the receptor species, use the lowest NOAEL for the receptor species.

- If an appropriate NOAEL is unavailable for the receptor species, use a NOAEL for a species which is phylogenetically similar (within the same genera or family) and ecologically similar to the selected receptor species (e.g. from the same family of birds or mammals).

- If an appropriate NOAEL is unavailable for a phylogenetically similar species, extrapolate from an appropriate NOAEL value for other species (as closely related as possible) by dividing by 5 to account for extrapolations between families and by 10 to account for extrapolations between orders. Use the lowest appropriate NOAEL whenever several studies are available.

- In the absence of an appropriate NOAEL, if a LOAEL is available for a phylogenetically similar species, divide it by 10 to account for a LOAEL to NOAEL conversion. The LOAEL to NOAEL conversion is similar to EPA's derivation of human health RfD values, where LOAEL studies are adjusted by a factor of 10 to estimate NOAEL values.

- For calculating chronic toxicity values from data for sub-chronic tests, divide the resultant LOAEL or NOAEL by an additional factor of 10. This is consistent with the methodology used to derive human RfD values. EPA has no clear guidance on the dividing line between subchronic and chronic exposures. The present risk assessment follows recently developed guidance (Sample et al., 1996) which considers 10 weeks to be the minimum time for chronic exposure of birds and 1 year for chronic exposure of mammals. In addition to duration of exposure, the time when exposure to contaminant occurs is critical.

- In cases where NOAELs are available as a dietary concentration (e.g., mg contaminant per kg food), calculate a daily dose for birds or mammals based on standard estimates of food intake rates and body weights (USEPA, 1993c).

6.0 DISCUSSION OF UNCERTAINTIES AND EXPOSURE ASSUMPTIONS

Sources of uncertainty and variability within the ERA will be identified. The impact associated with these uncertainties will be qualitatively addressed. Sensitivity analyses will be conducted for the important exposure parameters that are used in the wildlife exposure models and for the TRVs that are used to determine risk to the representative wildlife species.

7.0 REFERENCES

Nagy, K.A., (1987). "Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds". Ecological Monographs, 57(2), 1987, pp 111-128

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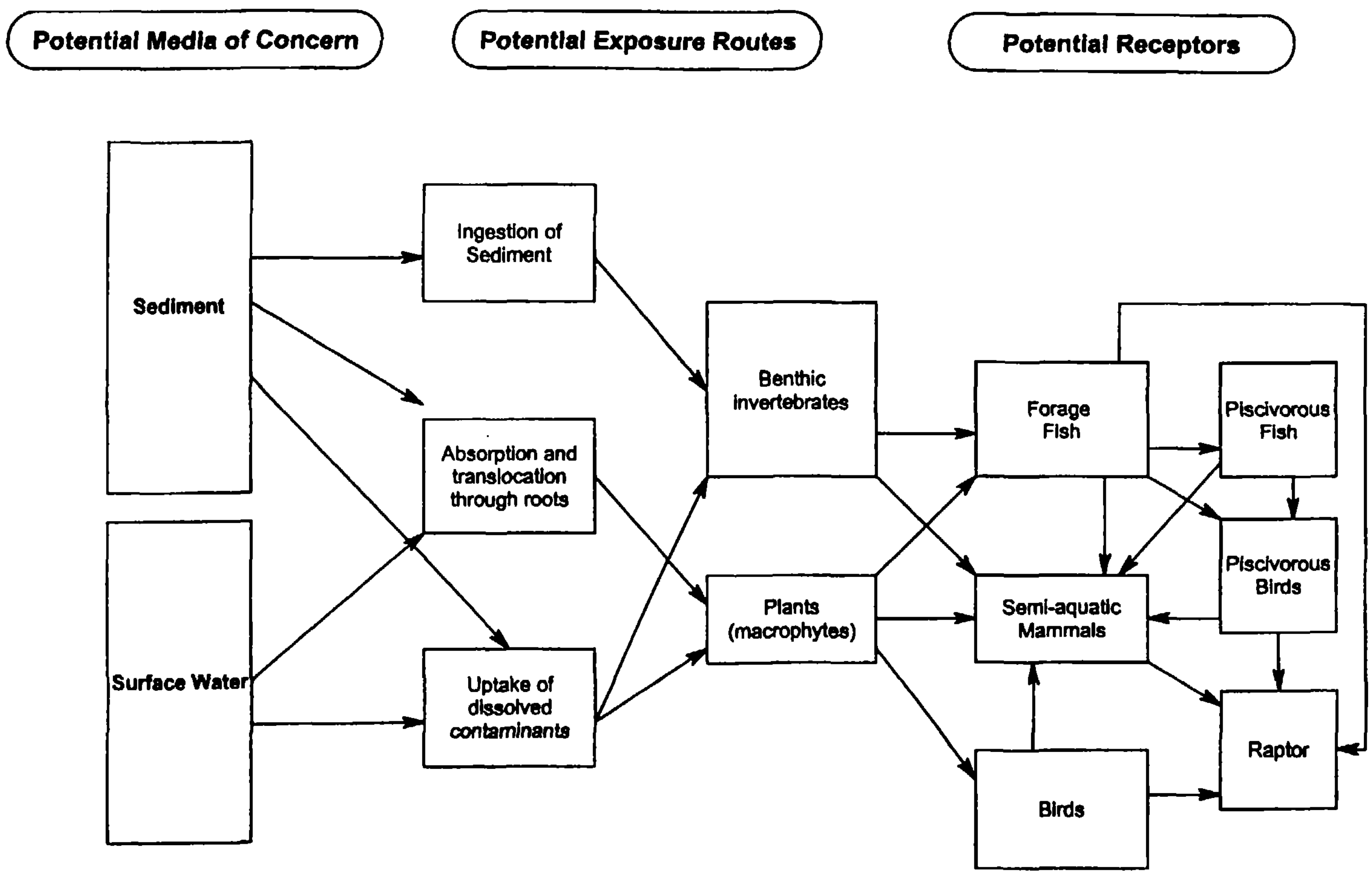
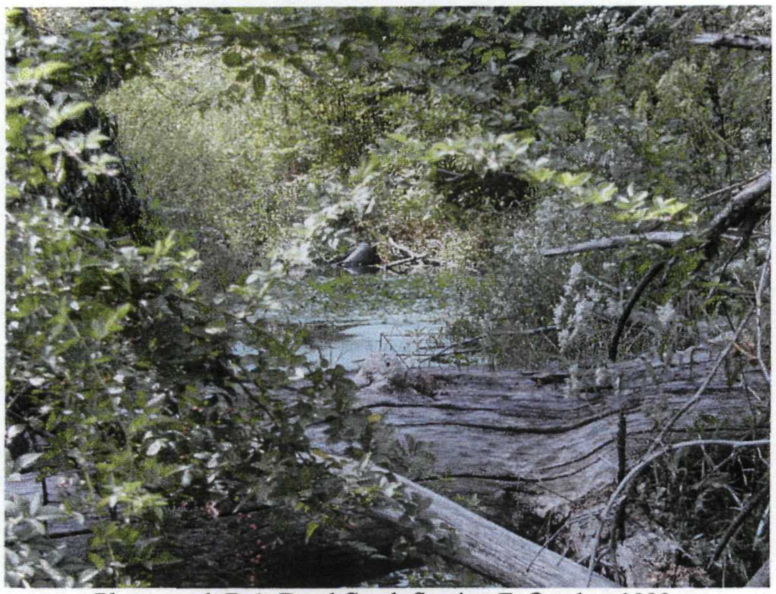
U.S. Environmental Protection Agency. (1993). Wildlife Exposure Factors Handbook. U.S. EPA Office of research and Development. EPA/600/R-93/187a.

Figure 1-C-1: Preliminary Ecological Conceptual Model

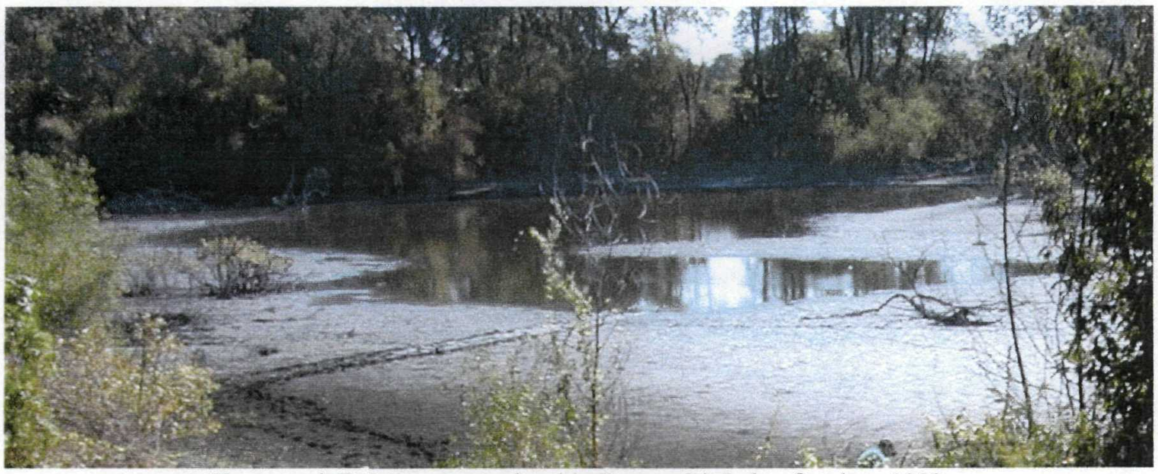


APPENDIX B

PHOTOGRAPHS



Photograph B-1 Dead Creek Section F, October 1999.



Photograph B-2 Low water level in Borrow Pit Lake, October, 1999.

Photograph B-3 Station 2 in Borrow Pit Lake, October, 1999.

Photograph B-4 Station 3 in Borrow Pit Lake, October, 1999.

Photograph B-5 Beach seining in reference location PDC-1 (Prairie DuPont Creek), October, 1999.

Photograph B-6 Reference location PDC-1 (Prairie DuPont Creek), October, 1999.

Photograph B-7 Reference location Ref2-1 (Creek Portion), October, 1999.

Photograph B-8 Reference location Ref2-2 (Lake Portion), October, 1999.

Photograph B-9 Vegetation, *Ranunculus reptans*, sample, covered with Duckweed, being washed , October, 1999.

Photograph B-10 Shrimp, *Palaemonetes kadiakensis*, (diameter of sieve is 8 inches), October 1999.

Photograph B-11 Clam, *Pyganodon grandis*, samples. Specimen in hand is about 5 inches across, October 1999.

APPENDIX C

SUMMARY STATISTICS FOR DATA

USED IN ECOLOGICAL RISK ASSESSMENT

Appendix C-1

Site Surface Water Summary Statistics
Dead Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/l						
2,4,5-T	6		0%			0.25
2,4,5-TP (Silvex)	6		0%			0.25
2,4-D	6		0%			0.25
2,4-DB	6		0%			0.25
Dalapon	6		0%			60
Dicamba	6		0%			0.60
Dichloroprop	6		0%			3.00
Dinoseb	6		0%			3.00
MCPA	6		0%			60
MCPP	6		0%			60
Pentachlorophenol	6		0%			0.50
Metals, mg/l						
Aluminum	6	6	100%	0.039	3.4	0.92
Antimony	6		0%			0.01
Arsenic	6	5	83%	0.0032	0.015	0.01
Barium	6	6	100%	0.045	0.32	0.14
Beryllium	6		0%			0.002
Cadmium	6		0%			0.003
Calcium	6	6	100%	47	89	58
Chromium	6	1	17%	0.0041	0.0041	0.005
Cobalt	6	1	17%	0.0015	0.0015	0.004
Copper	6	6	100%	0.0016	0.012	0.01
Cyanide, Total	6		0%			0.01
Iron	6	6	100%	0.5	8.7	2.28
Lead	6	5	83%	0.002	0.02	0.01
Magnesium	6	6	100%	26	33	31
Manganese	6	6	100%	0.082	1.7	0.39
Mercury	6		0%			0.0001
Molybdenum	6	3	50%	0.0028	0.004	0.004
Nickel	6	6	100%	0.0069	0.021	0.01
Potassium	6	6	100%	5.1	7.6	6.58
Selenium	6		0%			0.01
Silver	6		0%			0.01
Sodium	6	6	100%	21	24	22
Thallium	6		0%			0.01
Vanadium	6	4	67%	0.003	0.014	0.01
Zinc	6	6	100%	0.0073	0.075	0.03
Fluoride (mg/l)	6	6	100%	0.24	0.29	0.26
Hardness as CaCO3 (mg/l)	6	6	100%	220	350	272
Ortho-Phosphate-P (mg/l)	6	6	100%	0.063	0.83	0.25
pH	6	6	100%	7.4	9.7	8.47
Suspended Solids (mg/l)	6	5	83%	8	160	46
Total Dissolved Solids (mg/l)	6	6	100%	280	480	358
Total Phosphorus (mg/l)	6	6	100%	0.13	1.2	0.37
PCB, ug/l						
Decachlorobiphenyl	6		0%			0.25
Dichlorobiphenyl	6		0%			0.05
Heptachlorobiphenyl	6		0%			0.15
Hexachlorobiphenyl	6		0%			0.10
Monochlorobiphenyl	6		0%			0.05
Nonachlorobiphenyl	6		0%			0.25
Octachlorobiphenyl	6		0%			0.15
Pentachlorobiphenyl	6		0%			0.10
Tetrachlorobiphenyl	6		0%			0.10
Trichlorobiphenyl	6		0%			0.05
Total PCBs	6		0%			0.05
Pesticides, ug/l						
4,4'-DDD	6		0%			0.05
4,4'-DDE	6		0%			0.05
4,4'-DDT	6		0%			0.05
Total DDT	6		0%			0.05
Aldrin	6		0%			0.03
Alpha Chlordane	6		0%			0.03
alpha-BHC	6	2	33%	0.00047	0.001	0.01
beta-BHC	6	3	50%	0.0096	0.02	0.01
delta-BHC	6	2	33%	0.00013	0.0022	0.00

Site Surface Water Summary Statistics
Dead Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dieldrin	6	1	17%	0.001	0.001	0.04
Endosulfan I	6	2	33%	0.0015	0.0024	0.02
Endosulfan II	6		0%			0.05
Endosulfan sulfate	6	1	17%	0.0032	0.0032	0.04
Endrin	6	1	17%	0.00095	0.00095	0.04
Endrin aldehyde	6	2	33%	0.0016	0.0032	0.03
Endrin ketone	6	1	17%	0.0027	0.0027	0.04
Gamma Chlordane	6		0%			0.03
gamma-BHC (Lindane)	6	2	33%	0.0024	0.0038	0.01
Heptachlor	6	3	50%	0.0022	0.0029	0.01
Heptachlor epoxide	6	2	33%	0.0009	0.00096	0.02
Methoxychlor	6		0%			0.25
Toxaphene	6		0%			2.50
SVOCs, ug/l						
1,2,4-Trichlorobenzene	6		0%			5.00
1,2-Dichlorobenzene	6		0%			5.00
1,3-Dichlorobenzene	6		0%			5.00
1,4-Dichlorobenzene	6		0%			5.00
2,2'-Oxybis(1-Chloropropane)	6		0%			5.00
2,4,5-Trichlorophenol	6		0%			5.00
2,4,6-Trichlorophenol	6		0%			1.05
2,4-Dichlorophenol	6		0%			5.00
2,4-Dinitrophenol	6		0%			7.00
2,4-Dinitrotoluene	6		0%			5.00
2,6-Dinitrotoluene	6		0%			5.00
2-Chloronaphthalene	6		0%			5.00
2-Chlorophenol	6		0%			5.00
2-Methylnaphthalene	6		0%			5.00
2-Methylphenol (o-cresol)	6		0%			5.00
2-Nitroaniline	6		0%			25
2-Nitrophenol	6		0%			5.00
3,3'-Dichlorobenzidine	6		0%			10
3-Methylphenol/4-Methylphenol	6		0%			5.00
3-Nitroaniline	6		0%			25
4,6-Dinitro-2-methylphenol	6		0%			6.50
4-Bromophenylphenyl ether	6		0%			0.50
4-Chloro-3-methylphenol	6		0%			5.00
4-Chloroaniline	6		0%			10.00
4-Chlorophenylphenyl ether	6		0%			5.00
4-Nitroaniline	6		0%			25
4-Nitrophenol	6		0%			25
Acenaphthene	6		0%			5.00
Acenaphthylene	6		0%			5.00
Anthracene	6		0%			5.00
Benzo(a)anthracene	6		0%			5.00
Benzo(a)pyrene	6		0%			5.00
Benzo(b)fluoranthene	6		0%			5.00
Benzo(g,h,i)perylene	6		0%			5.00
Benzo(k)fluoranthene	6		0%			5.00
bis(2-Chloroethoxy)methane	6		0%			5.00
bis(2-Chloroethyl)ether	6		0%			5.00
bis(2-Ethylhexyl)phthalate	6		0%			0.90
Butylbenzylphthalate	6		0%			5.00
Carbazole	6		0%			5.00
Chrysene	6		0%			5.00
Di-n-butylphthalate	6		0%			5.00
Di-n-octylphthalate	6		0%			5.00
Dibenzo(a,h)anthracene	6		0%			5.00
Dibenzofuran	6		0%			5.00
Diethylphthalate	6		0%			5.00
Dimethylphthalate	6		0%			5.00
Fluoranthene	6	1	17%	0.7	0.7	4.28
Fluorene	6		0%			0.50
Hexachlorobenzene	6		0%			5.00
Hexachlorobutadiene	6		0%			5.00
Hexachlorocyclopentadiene	6		0%			5.00
Hexachloroethane	6		0%			0.95
Indeno(1,2,3-cd)pyrene	6		0%			5.00
Isophorone	6		0%			5.00

Site Surface Water Summary Statistics
Dead Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
N-Nitroso-di-n-propylamine	6		0%			5.00
N-Nitrosodiphenylamine	6		0%			2.50
Naphthalene	6		0%			5.00
Nitrobenzene	6		0%			1.75
Pentachlorophenol	6		0%			2.50
Phenanthrene	6	1	17%	0.7	0.7	4.28
Phenol	6		0%			5.00
Pyrene	6		0%			5.00
Total PAHs	6	1	17%	0.7	0.7	4.3
VOCs, ug/l						
1,1,1-Trichloroethane	6		0%			2.5
1,1,2,2-Tetrachloroethane	6		0%			2.5
1,1,2-Trichloroethane	6		0%			2.5
1,1-Dichloroethane	6		0%			2.5
1,1-Dichloroethene	6		0%			2.5
1,2-Dichloroethane	6		0%			2.5
1,2-Dichloropropane	6		0%			2.5
2-Butanone (MEK)	6		0%			12.5
2-Hexanone	6		0%			12.5
4-Methyl-2-pentanone (MIBK)	6		0%			12.5
Acetone	6	3	50%	13	18	20
Benzene	6	1	17%	1.7	1.7	0.78
Bromodichloromethane	6		0%			2.5
Bromoform	6		0%			2.5
Bromomethane (Methyl bromide)	6		0%			4.9
Carbon disulfide	6		0%			2.5
Carbon tetrachloride	6		0%			2.5
Chlorobenzene	6		0%			2.5
Chloroethane	6		0%			5
Chloroform	6		0%			2.5
Chloromethane	6		0%			5
cis-1,3-Dichloropropene	6		0%			0.5
Cis/Trans-1,2-Dichloroethene	6		0%			2.5
Dibromochloromethane	6		0%			2.5
Ethylbenzene	6		0%			2.5
Methylene chloride	6		0%			2.35
Styrene	6		0%			2.5
Tetrachloroethene	6		0%			2.5
Toluene	6		0%			2.5
trans-1,3-Dichloropropene	6		0%			2.5
Trichloroethene	6		0%			1.35
Vinyl chloride	6		0%			5
Xylenes, Total	6		0%			2.5

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Site Surface Water Dioxin Data Summary
Dead Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dioxins and Furans, ug/l						
1,2,3,4,6,7,8,9-OCDD	6	5	83%	0.000573	0.00143	0.000707667
1,2,3,4,6,7,8,9-OCDF	6	5	83%	0.0000503	0.00026	0.000120533
1,2,3,4,6,7,8-HpCDD	6	4	67%	0.0000442	0.0000692	4.41417E-05
1,2,3,4,6,7,8-HpCDF	6	6	100%	0.0000134	0.0000505	2.71667E-05
1,2,3,4,7,8,9-HpCDF	6	1	17%	0.000548	0.000548	9.44917E-05
1,2,3,4,7,8-HxCDD	6		0%			2.73333E-06
1,2,3,4,7,8-HxCDF	6	1	17%	0.000024	0.000024	0.00000605
1,2,3,6,7,8-HxCDD	6		0%			2.55833E-06
1,2,3,6,7,8-HxCDF	6	1	17%	0.0000089	0.0000089	3.39167E-06
1,2,3,7,8,9-HxCDD	6		0%			2.65833E-06
1,2,3,7,8,9-HxCDF	6		0%			2.66667E-06
1,2,3,7,8-PeCDD	6		0%			3.19167E-06
1,2,3,7,8-PeCDF	6		0%			2.04167E-06
2,3,4,6,7,8-HxCDF	6		0%			0.000002375
2,3,4,7,8-PeCDF	6		0%			0.00000215
2,3,7,8-TCDD	6		0%			2.95833E-06
2,3,7,8-TCDF	6		0%			2.51667E-06
Total HpCDD	6	4	67%	0.0000935	0.000128	9.07333E-05
Total HpCDF	6	5	83%	0.0000416	0.0006	0.00016505
Total HxCDD	6	2	33%	0.0000062	0.0000902	0.00001905
Total HxCDF	6	2	33%	0.0000249	0.000581	0.000103583
Total PeCDD	6		0%			3.19167E-06
Total PeCDF	6		0%			0.0000021
Total TCDD	6		0%			2.95833E-06
Total TCDF	6		0%			2.51667E-06

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Dead Creek Sector F Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/l						
2,4,5-T (ug/l)	3		0%			0.25
2,4,5-TP (Silvex)	3		0%			0.25
2,4-D	3		0%			0.25
2,4-DB	3		0%			0.25
Dalapon	3		0%			60
Dicamba	3		0%			0.60
Dichloroprop	3		0%			3.00
Dinoseb	3		0%			3.00
MCPA	3		0%			60
MCPP	3		0%			60
Pentachlorophenol	3		0%			0.50
Metals, mg/l						
Aluminum	3	3	100%	0.039	0.55	0.25
Antimony	3		0%			0.01
Arsenic	3	2	67%	0.0032	0.0049	0.00
Barium	3	3	100%	0.12	0.13	0.13
Beryllium	3		0%			0.002
Cadmium	3		0%			0.003
Calcium	3	3	100%	52	53	53
Chromium	3		0%			0.01
Cobalt	3		0%			0.01
Copper	3	3	100%	0.0016	0.012	0.01
Cyanide, Total	3		0%			0.01
Iron	3	3	100%	0.5	1	0.68
Lead	3	2	67%	0.0022	0.0037	0.003
Magnesium	3	3	100%	30	33	32
Manganese	3	3	100%	0.082	0.14	0.11
Mercury	3		0%			0.0001
Molybdenum	3	1	33%	0.0028	0.0028	0.004
Nickel	3	3	100%	0.0069	0.021	0.01
Potassium	3	3	*100%*	*6.4*	*6.9*	*6.60*
Selenium	3		0%			0.01
Silver	3		0%			0.01
Sodium	3	3	100%	21	22	21
Thallium	3		0%			0.01
Vanadium	3	1	33%	0.003	0.003	0.004
Zinc	3	3	100%	0.0073	0.075	0.04
Fluoride (mg/l)	3	3	100%	0.24	0.27	0.25
Hardness as CaCO3 (mg/l)	3	3	100%	260	270	263
Ortho-Phosphate-P (mg/l)	3	3	100%	0.063	0.12	0.09
pH	3	3	100%	7.4	8.6	7.87
Suspended Solids (mg/l)	3	2	67%	8	12	7.50
Total Dissolved Solids (mg/l)	3	3	100%	330	360	347
Total Phosphorus (mg/l)	3	3	100%	0.13	0.18	0.15
PCB, ug/l						
Decachlorobiphenyl (ug/l)	3		0%			0.25
Dichlorobiphenyl	3		0%			0.05
Heptachlorobiphenyl	3		0%			0.15
Hexachlorobiphenyl	3		0%			0.10
Monochlorobiphenyl	3		0%			0.05
Nonachlorobiphenyl	3		0%			0.25
Octachlorobiphenyl	3		0%			0.15
Pentachlorobiphenyl	3		0%			0.10
Tetrachlorobiphenyl	3		0%			0.10
Trichlorobiphenyl	3		0%			0.05
Pesticides, ug/l						
4,4'-DDD	3		0%			0.05
4,4'-DDE	3		0%			0.05
4,4'-DDT	3		0%			0.05
Aldrin	3		0%			0.03
Alpha Chlordane	3		0%			0.03
alpha-BHC	3		0%			0.02
beta-BHC	3		0%			0.01
delta-BHC	3		0%			0.01
Dieldrin	3		0%			0.05
Endosulfan I	3		0%			0.03
Endosulfan II	3		0%			0.05
Endosulfan sulfate	3		0%			0.05
Endrin	3		0%			0.05
Endrin aldehyde	3		0%			0.05
Endrin ketone	3		0%			0.05
Gamma Chlordane	3		0%			0.03
gamma-BHC (Lindane)	3		0%			0.01
Heptachlor	3		0%			0.03
Heptachlor epoxide	3		0%			0.03
Methoxychlor	3		0%			0.25
Toxaphene	3		0%			2.50

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Dead Creek Sector F Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
SVOCs, ug/l						
1,2,4-Trichlorobenzene	3		0%			5.00
1,2-Dichlorobenzene	3		0%			5.00
1,3-Dichlorobenzene	3		0%			5.00
1,4-Dichlorobenzene	3		0%			5.00
2,2'-Oxybis(1-Chloropropane)	3		0%			5.00
2,4,5-Trichlorophenol	3		0%			5.00
2,4,6-Trichlorophenol	3		0%			1.05
2,4-Dichlorophenol	3		0%			5.00
2,4-Dinitrophenol	3		0%			7.00
2,4-Dinitrotoluene	3		0%			5.00
2,6-Dinitrotoluene	3		0%			5.00
2-Chloronaphthalene	3		0%			5.00
2-Chlorophenol	3		0%			5.00
2-Methylnaphthalene	3		0%			5.00
2-Methylphenol (o-cresol)	3		0%			5.00
2-Nitroaniline	3		0%			25
2-Nitrophenol	3		0%			5.00
3,3'-Dichlorobenzidine	3		0%			10
3-Methylphenol/4-Methylphenol	3		0%			5.00
3-Nitroaniline	3		0%			25
4,6-Dinitro-2-methylphenol	3		0%			6.50
4-Bromophenylphenyl ether	3		0%			0.50
4-Chloro-3-methylphenol	3		0%			5.00
4-Chloroaniline	3		0%			10
4-Chlorophenylphenyl ether	3		0%			5.00
4-Nitroaniline	3		0%			25
4-Nitrophenol	3		0%			25
Acenaphthene	3		0%			5.00
Acenaphthylene	3		0%			5.00
Anthracene	3		0%			5.00
Benzo(a)anthracene	3		0%			5.00
Benzo(a)pyrene	3		0%			5.00
Benzo(b)fluoranthene	3		0%			5.00
Benzo(g,h,i)perylene	3		0%			5.00
Benzo(k)fluoranthene	3		0%			5.00
bis(2-Chloroethoxy)methane	3		0%			5.00
bis(2-Chloroethyl)ether	3		0%			5.00
bis(2-Ethylhexyl)phthalate	3		0%			0.90
Butylbenzylphthalate	3		0%			5.00
Carbazole	3		0%			5.00
Chrysene	3		0%			5.00
Di-n-butylphthalate	3		0%			5.00
Di-n-octylphthalate	3		0%			5.00
Dibenzo(a,h)anthracene	3		0%			5.00
Dibenzofuran	3		0%			5.00
Diethylphthalate	3		0%			5.00
Dimethylphthalate	3		0%			5.00
Fluoranthene	3	1	33%	0.7	0.7	3.57
Fluorene	3		0%			0.50
Hexachlorobenzene	3		0%			5.00
Hexachlorobutadiene	3		0%			5.00
Hexachlorocyclopentadiene	3		0%			5.00
Hexachloroethane	3		0%			0.95
Indeno(1,2,3-cd)pyrene	3		0%			5.00
Isophorone	3		0%			5.00
N-Nitroso-di-n-propylamine	3		0%			5.00
N-Nitrosodiphenylamine	3		0%			2.50
Naphthalene	3		0%			5.00
Nitrobenzene	3		0%			1.75
Pentachlorophenol	3		0%			2.50
Phenanthrene	3	1	33%	0.7	0.7	3.57
Phenol	3		0%			5.00
Pyrene	3		0%			5.00
Total PAHs	3	1	33%	0.7	0.7	3.6
VOCs, ug/l						
1,1,1-Trichloroethane	3		0%			2.5
1,1,2,2-Tetrachloroethane	3		0%			2.5
1,1,2-Trichloroethane	3		0%			2.5
1,1-Dichloroethane	3		0%			2.5
1,1-Dichloroethene	3		0%			2.5
1,2-Dichloroethane	3		0%			2.5
1,2-Dichloropropane	3		0%			2.5
2-Butanone (MEK)	3		0%			12.5
2-Hexanone	3		0%			12.5
4-Methyl-2-pentanone (MIBK)	3		0%			12.5
Acetone	3		0%			25
Benzene	3	1	33%	1.7	1.7	0.967
Bromodichloromethane	3		0%			2.5
Bromoform	3		0%			2.5
Bromomethane (Methyl bromide)	3		0%			4.9
Carbon disulfide	3		0%			2.5
Carbon tetrachloride	3		0%			2.5
Chlorobenzene	3		0%			2.5
Chloroethane	3		0%			5

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Dead Creek Sector F Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Chloroform	3		0%			2.5
Chloromethane	3		0%			5
cis-1,3-Dichloropropene	3		0%			0.5
Cis/Trans-1,2-Dichloroethene	3		0%			2.5
Dibromochloromethane	3		0%			2.5
Ethylbenzene	3		0%			2.5
Methylene chloride	3		0%			2.35
Styrene	3		0%			2.5
Tetrachloroethene	3		0%			2.5
Toluene	3		0%			2.5
trans-1,3-Dichloropropene	3		0%			2.5
Trichloroethene	3		0%			1.35
Vinyl chloride	3		0%			5
Xylenes, Total	3		0%			2.5

Appendix C-1

Dioxin Surface Water Data Summary for Dead Creek Sector F
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dioxins and Furans, ug/l						
1,2,3,4,6,7,8,9-OCDD	3	2	67%	0.000573	0.000617	0.000424333
1,2,3,4,6,7,8,9-OCDF	3	3	100%	0.0000817	0.00026	0.000190567
1,2,3,4,6,7,8-HpCDD	3	2	67%	0.0000629	0.0000692	4.70833E-05
1,2,3,4,6,7,8-HpCDF	3	3	100%	0.0000134	0.0000505	3.63333E-05
1,2,3,4,7,8,9-HpCDF	3	1	33%	0.000548	0.000548	0.00018415
1,2,3,4,7,8-HxCDD	3		0%			2.11667E-06
1,2,3,4,7,8-HxCDF	3	1	33%	0.000024	0.000024	8.98333E-06
1,2,3,6,7,8-HxCDD	3		0%			1.98333E-06
1,2,3,6,7,8-HxCDF	3	1	33%	0.0000089	0.0000089	3.88333E-06
1,2,3,7,8,9-HxCDD	3		0%			2.06667E-06
1,2,3,7,8,9-HxCDF	3		0%			1.88333E-06
1,2,3,7,8-PeCDD	3		0%			3.13333E-06
1,2,3,7,8-PeCDF	3		0%			0.0000018
2,3,4,6,7,8-HxCDF	3		0%			1.68333E-06
2,3,4,7,8-PeCDF	3		0%			0.0000019
2,3,7,8-TCDD	3		0%			0.0000026
2,3,7,8-TCDF	3		0%			1.96667E-06
Total HpCDD	3	2	67%	0.000127	0.000128	0.0000913
Total HpCDF	3	2	67%	0.000182	0.0006	0.0002825
Total HxCDD	3	1	33%	0.0000902	0.0000902	3.36667E-05
Total HxCDF	3	2	67%	0.0000249	0.000581	0.00020405
Total PeCDD	3		0%			3.13333E-06
Total PeCDF	3		0%			0.00000185
Total TCDD	3		0%			0.0000026
Total TCDF	3		0%			1.96667E-06

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Borrow Pit Lake Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/l						
2,4,5-T (ug/l)	3		0%			0.25
2,4,5-TP (Silvex)	3		0%			0.25
2,4-D	3		0%			0.25
2,4-DB	3		0%			0.25
Dalapon	3		0%			60
Dicamba	3		0%			0.60
Dichloroprop	3		0%			3.00
Dinoseb	3		0%			3.00
MCPA	3		0%			60
MCPP	3		0%			60
Pentachlorophenol	3		0%			0.50
Metals, mg/l						
Aluminum	3	3	100%	0.65	3.4	1.59
Antimony	3		0%			0.01
Arsenic	3	3	100%	0.0079	0.015	0.01
Barium	3	3	100%	0.045	0.32	0.16
Beryllium	3		0%			0.002
Cadmium	3		0%			0.003
Calcium	3	3	100%	47	89	64
Chromium	3	1	33%	0.0041	0.0041	0.005
Cobalt	3	1	33%	0.0015	0.0015	0.004
Copper	3	3	100%	0.0036	0.0074	0.01
Cyanide, Total	3		0%			0.01
Iron	3	3	100%	1.3	8.7	3.87
Lead	3	3	100%	0.002	0.02	0.01
Magnesium	3	3	100%	26	31	29
Manganese	3	3	100%	0.13	1.7	0.67
Mercury	3		0%			0.000
Molybdenum	3	2	67%	0.0035	0.004	0.004
Nickel	3	3	100%	0.0077	0.015	0.01
Potassium	3	3	100%	5.1	7.6	6.57
Selenium	3		0%			0.01
Silver	3		0%			0.01
Sodium	3	3	100%	21	24	22
Thallium	3		0%			0.01
Vanadium	3	3	100%	0.0051	0.014	0.01
Zinc	3	3	100%	0.017	0.048	0.03
Fluoride (mg/l)	3	3	100%	0.25	0.29	0.26
Hardness as CaCO3 (mg/l)	3	3	100%	220	350	280
Ortho-Phosphate-P (mg/l)	3	3	100%	0.2	0.83	0.42
pH	3	3	100%	8.5	9.7	9.07
Suspended Solids (mg/l)	3	3	100%	37	160	84
Total Dissolved Solids (mg/l)	3	3	100%	280	480	370
Total Phosphorus (mg/l)	3	3	100%	0.26	1.2	0.59
PCBs, ug/l						
Decachlorobiphenyl (ug/l)	3		0%			0.25
Dichlorobiphenyl	3		0%			0.05
Heptachlorobiphenyl	3		0%			0.15
Hexachlorobiphenyl	3		0%			0.10
Monochlorobiphenyl	3		0%			0.05
Nonachlorobiphenyl	3		0%			0.25
Octachlorobiphenyl	3		0%			0.15
Pentachlorobiphenyl	3		0%			0.10
Tetrachlorobiphenyl	3		0%			0.10
Trichlorobiphenyl	3		0%			0.05
Pesticides, ug/l						
4,4'-DDD	3		0%			0.05
4,4'-DDE	3		0%			0.05
4,4'-DDT	3		0%			0.05
Aldrin	3		0%			0.03
Alpha Chlordane	3		0%			0.03
alpha-BHC	3	2	67%	0.00047	0.001	0.01
beta-BHC	3	3	100%	0.0096	0.02	0.01
delta-BHC	3	2	67%	0.00013	0.0022	0.00
Dieldrin	3	1	33%	0.001	0.001	0.03
Endosulfan I	3	2	67%	0.0015	0.0024	0.01
Endosulfan II	3		0%			0.05
Endosulfan sulfate	3	1	33%	0.0032	0.0032	0.03

Appendix C-1

Borrow Pit Lake Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Endrin	3	1	33%	0.00095	0.00095	0.03
Endrin aldehyde	3	2	67%	0.0016	0.0032	0.02
Endrin ketone	3	1	33%	0.0027	0.0027	0.03
Gamma Chlordane	3		0%			0.03
gamma-BHC (Lindane)	3	2	67%	0.0024	0.0038	0.01
Heptachlor	3	3	100%	0.0022	0.0029	0.003
Heptachlor epoxide	3	2	67%	0.0009	0.00096	0.01
Methoxychlor	3		0%			0.25
Toxaphene	3		0%			2.50
SVOCs, ug/l						
1,2,4-Trichlorobenzene	3		0%			5.00
1,2-Dichlorobenzene	3		0%			5.00
1,3-Dichlorobenzene	3		0%			5.00
1,4-Dichlorobenzene	3		0%			5.00
2,2'-Oxybis(1-Chloropropane)	3		0%			5.00
2,4,5-Trichlorophenol	3		0%			5.00
2,4,6-Trichlorophenol	3		0%			1.05
2,4-Dichlorophenol	3		0%			5.00
2,4-Dinitrophenol	3		0%			7.00
2,4-Dinitrotoluene	3		0%			5.00
2,6-Dinitrotoluene	3		0%			5.00
2-Chloronaphthalene	3		0%			5.00
2-Chlorophenol	3		0%			5.00
2-Methylnaphthalene	3		0%			5.00
2-Methylphenol (o-cresol)	3		0%			5.00
2-Nitroaniline	3		0%			25
2-Nitrophenol	3		0%			5.00
3,3'-Dichlorobenzidine	3		0%			10
3-Methylphenol/4-Methylphenol	3		0%			5.00
3-Nitroaniline	3		0%			25
4,6-Dinitro-2-methylphenol	3		0%			6.50
4-Bromophenylphenyl ether	3		0%			0.50
4-Chloro-3-methylphenol	3		0%			5.00
4-Chloroaniline	3		0%			10
4-Chlorophenylphenyl ether	3		0%			5.00
4-Nitroaniline	3		0%			25
4-Nitrophenol	3		0%			25
Acenaphthene	3		0%			5.00
Acenaphthylene	3		0%			5.00
Anthracene	3		0%			5.00
Benzo(a)anthracene	3		0%			5.00
Benzo(a)pyrene	3		0%			5.00
Benzo(b)fluoranthene	3		0%			5.00
Benzo(g,h,i)perylene	3		0%			5.00
Benzo(k)fluoranthene	3		0%			5.00
bis(2-Chloroethoxy)methane	3		0%			5.00
bis(2-Chloroethyl)ether	3		0%			5.00
bis(2-Ethylhexyl)phthalate	3		0%			0.90
Butylbenzylphthalate	3		0%			5.00
Carbazole	3		0%			5.00
Chrysene	3		0%			5.00
Di-n-butylphthalate	3		0%			5.00
Di-n-octylphthalate	3		0%			5.00
Dibenzo(a,h)anthracene	3		0%			5.00
Dibenzofuran	3		0%			5.00
Diethylphthalate	3		0%			5.00
Dimethylphthalate	3		0%			5.00
Fluoranthene	3		0%			5.00
Fluorene	3		0%			0.50
Hexachlorobenzene	3		0%			5.00
Hexachlorobutadiene	3		0%			5.00
Hexachlorocyclopentadiene	3		0%			5.00
Hexachloroethane	3		0%			0.95
Indeno(1,2,3-cd)pyrene	3		0%			5.00
Isophorone	3		0%			5.00
N-Nitroso-di-n-propylamine	3		0%			5.00
N-Nitrosodiphenylamine	3		0%			2.50
Naphthalene	3		0%			5.00
Nitrobenzene	3		0%			1.75
Pentachlorophenol	3		0%			2.50
Phenanthrene	3		0%			5.00
Phenol	3		0%			5.00
Pyrene	3		0%			5.00

Appendix C-1

Borrow Pit Lake Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
VOCs, ug/l						
1,1,1-Trichloroethane	3		0%			2.5
1,1,2,2-Tetrachloroethane	3		0%			2.5
1,1,2-Trichloroethane	3		0%			2.5
1,1-Dichloroethane	3		0%			2.5
1,1-Dichloroethene	3		0%			2.5
1,2-Dichloroethane	3		0%			2.5
1,2-Dichloropropane	3		0%			2.5
2-Butanone (MEK)	3		0%			12.5
2-Hexanone	3		0%			12.5
4-Methyl-2-pentanone (MIBK)	3		0%			12.5
Acetone	3	3	100%	13	18	15
Benzene	3		0%			0.6
Bromodichloromethane	3		0%			2.5
Bromoform	3		0%			2.5
Bromomethane (Methyl bromide)	3		0%			4.9
Carbon disulfide	3		0%			2.5
Carbon tetrachloride	3		0%			2.5
Chlorobenzene	3		0%			2.5
Chloroethane	3		0%			5
Chloroform	3		0%			2.5
Chloromethane	3		0%			5
cis-1,3-Dichloropropene	3		0%			0.5
Cis/Trans-1,2-Dichloroethene	3		0%			2.5
Dibromochloromethane	3		0%			2.5
Ethylbenzene	3		0%			2.5
Methylene chloride	3		0%			2.35
Styrene	3		0%			2.5
Tetrachloroethene	3		0%			2.5
Toluene	3		0%			2.5
trans-1,3-Dichloropropene	3		0%			2.5
Trichloroethene	3		0%			1.35
Vinyl chloride	3		0%			5
Xylenes, Total	3		0%			2.5

Appendix C-1

Dioxin Surface Water Summary Statistics Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dioxins and Furans, ug/l						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	0.000751	0.00143	0.000991
1,2,3,4,6,7,8,9-OCDF	3	2	67%	0.0000503	0.000071	0.0000505
1,2,3,4,6,7,8-HpCDD	3	2	67%	0.0000442	0.0000569	0.0000412
1,2,3,4,6,7,8-HpCDF	3	3	100%	0.0000144	0.0000217	0.000018
1,2,3,4,7,8,9-HpCDF	3		0%			4.83333E-06
1,2,3,4,7,8-HxCDD	3		0%			0.00000335
1,2,3,4,7,8-HxCDF	3		0%			3.11667E-06
1,2,3,6,7,8-HxCDD	3		0%			3.13333E-06
1,2,3,6,7,8-HxCDF	3		0%			0.0000029
1,2,3,7,8,9-HxCDD	3		0%			0.00000325
1,2,3,7,8,9-HxCDF	3		0%			0.00000345
1,2,3,7,8-PeCDD	3		0%			0.00000325
1,2,3,7,8-PeCDF	3		0%			2.28333E-06
2,3,4,6,7,8-HxCDF	3		0%			3.06667E-06
2,3,4,7,8-PeCDF	3		0%			0.0000024
2,3,7,8-TCDD	3		0%			3.31667E-06
2,3,7,8-TCDF	3		0%			3.06667E-06
Total HpCDD	3	2	67%	0.0000935	0.000122	9.01667E-05
Total HpCDF	3	3	100%	0.0000416	0.0000551	0.0000476
Total HxCDD	3	1	33%	0.0000062	0.0000062	4.43333E-06
Total HxCDF	3		0%			3.11667E-06
Total PeCDD	3		0%			0.00000325
Total PeCDF	3		0%			0.00000235
Total TCDD	3		0%			3.31667E-06
Total TCDF	3		0%			3.06667E-06

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Reference Area Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/l						
2,4,5-T	4		0%			0.25
2,4,5-TP (Silvex)	4		0%			0.25
2,4-D	4		0%			0.25
2,4-DB	4		0%			0.25
Dalapon	4		0%			60
Dicamba	4		0%			0.60
Dichloroprop	4		0%			3.00
Dinoseb	4		0%			3.00
MCPA	4		0%			60
MCPP	4		0%			60
Pentachlorophenol	4		0%			0.50
Metals, mg/l						
Aluminum	4	4	100%	9.4	19.5	13
Antimony	4		0%			0.01
Arsenic	4	4	100%	0.0093	0.017	0.01
Barium	4	4	100%	0.32	0.41	0.36
Beryllium	4	2	50%	0.000665	0.00083	0.001
Cadmium	4		0%			0.003
Calcium	4	4	100%	50	72	59
Chromium	4	4	100%	0.011	0.0225	0.02
Cobalt	4	4	100%	0.0047	0.0076	0.01
Copper	4	4	100%	0.0097	0.0185	0.01
Cyanide, Total	4		0%			0.01
Iron	4	4	100%	11	25.5	16
Lead	4	4	100%	0.02	0.032	0.03
Magnesium	4	4	100%	23	35	27
Manganese	4	4	100%	1.5	2.9	1.98
Mercury	4		0%			0.0001
Molybdenum	4	4	100%	0.0032	0.00655	0.01
Nickel	4	4	100%	0.013	0.0245	0.02
Potassium	4	4	100%	7	11	8.50
Selenium	4		0%			0.01
Silver	4		0%			0.01
Sodium	4	4	100%	16	23	19
Thallium	4		0%			0.01
Vanadium	4	4	100%	0.031	0.0525	0.04
Zinc	4	4	100%	0.042	0.13	0.08
Fluoride (mg/l)	4	4	100%	0.23	0.38	0.31
Hardness as CaCO3 (mg/l)	4	4	100%	220	330	256
Ortho-Phosphate-P (mg/l)	4	3	75%	0.089	0.215	0.12
pH	4	4	100%	7.3	8.1	7.83
Suspended Solids (mg/l)	4	4	100%	270	700	420
Total Dissolved Solids (mg/l)	4	4	100%	310	460	368
Total Phosphorus (mg/l)	4	4	100%	0.87	3	1.64
PCB, ug/l						
Decachlorobiphenyl	4		0%			0.25
Dichlorobiphenyl	4		0%			0.05
Heptachlorobiphenyl	4		0%			0.15
Hexachlorobiphenyl	4		0%			0.10
Monochlorobiphenyl	4		0%			0.05
Nonachlorobiphenyl	4		0%			0.25
Octachlorobiphenyl	4		0%			0.15
Pentachlorobiphenyl	4		0%			0.10
Tetrachlorobiphenyl	4		0%			0.10
Trichlorobiphenyl	4		0%			0.05
Pesticides, ug/l	4		0%			0.05
4,4'-DDE	4	1	25%	0.0015	0.0015	0.04
4,4'-DDT	4	1	25%	0.0057	0.0057	0.04
Aldrin	4	2	50%	0.0024	0.004	0.01
Alpha Chlordane	4	2	50%	0.0019	0.013	0.02
alpha-BHC	4	1	25%	0.00155	0.00155	0.02
beta-BHC	4	4	100%	0.0048	0.015	0.01
delta-BHC	4	1	25%	0.007	0.007	0.01
Dieldrin	4	2	50%	0.0021	0.0036	0.03
Endosulfan I	4	4	100%	0.0017	0.026	0.01
Endosulfan II	4	1	25%	0.000096	0.000096	0.04
Endosulfan sulfate	4	3	75%	0.0028	0.007	0.02
Endrin	4	2	50%	0.00048	0.0054	0.03

Reference Area Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Endrin aldehyde	4	1	25%	0.05115	0.05115	0.05
Endrin ketone	4	2	50%	0.0047	0.011	0.03
Gamma Chlordane	4	2	50%	0.00082	0.0031	0.01
gamma-BHC (Lindane)	4	4	100%	0.001	0.01155	0.01
Heptachlor	4	1	25%	0.0035	0.0035	0.02
Heptachlor epoxide	4	4	100%	0.0047	0.0082	0.01
Methoxychlor	4		0%			0.25
Toxaphene	4		0%			2.50
SVOCs, ug/l						
1,2,4-Trichlorobenzene	4		0%			5.00
1,2-Dichlorobenzene	4		0%			5.00
1,3-Dichlorobenzene	4		0%			5.00
1,4-Dichlorobenzene	4		0%			5.00
2,2'-Oxybis(1-Chloropropane)	4		0%			5.00
2,4,5-Trichlorophenol	4		0%			5.00
2,4,6-Trichlorophenol	4		0%			1.05
2,4-Dichlorophenol	4		0%			5.00
2,4-Dinitrophenol	4		0%			7.00
2,4-Dinitrotoluene	4		0%			5.00
2,6-Dinitrotoluene	4		0%			5.00
2-Chloronaphthalene	4		0%			5.00
2-Chlorophenol	4		0%			5.00
2-Methylnaphthalene	4		0%			5.00
2-Methylphenol (o-cresol)	4		0%			5.00
2-Nitroaniline	4		0%			25
2-Nitrophenol	4		0%			5.00
3,3'-Dichlorobenzidine	4		0%			10
3-Methylphenol/4-Methylphenol	4		0%			5.00
3-Nitroaniline	4		0%			25
4,6-Dinitro-2-methylphenol	4		0%			6.50
4-Bromophenylphenyl ether	4		0%			0.50
4-Chloro-3-methylphenol	4		0%			5.00
4-Chloroaniline	4		0%			10
4-Chlorophenylphenyl ether	4		0%			5.00
4-Nitroaniline	4		0%			25
4-Nitrophenol	4		0%			25
Acenaphthene	4		0%			5.00
Acenaphthylene	4		0%			5.00
Anthracene	4		0%			5.00
Benzo(a)anthracene	4		0%			5.00
Benzo(a)pyrene	4		0%			5.00
Benzo(b)fluoranthene	4		0%			5.00
Benzo(g,h,i)perylene	4		0%			5.00
Benzo(k)fluoranthene	4		0%			5.00
bis(2-Chloroethoxy)methane	4		0%			5.00
bis(2-Chloroethyl)ether	4		0%			5.00
bis(2-Ethylhexyl)phthalate	4		0%			0.90
Butylbenzylphthalate	4		0%			5.00
Carbazole	4		0%			5.00
Chrysene	4		0%			5.00
Di-n-butylphthalate	4		0%			5.00
Di-n-octylphthalate	4		0%			5.00
Dibenzo(a,h)anthracene	4		0%			5.00
Dibenzofuran	4		0%			5.00
Diethylphthalate	4		0%			5.00
Dimethylphthalate	4		0%			5.00
Fluoranthene	4		0%			5.00
Fluorene	4		0%			0.50
Hexachlorobenzene	4		0%			5.00
Hexachlorobutadiene	4		0%			5.00
Hexachlorocyclopentadiene	4		0%			5.00
Hexachloroethane	4		0%			0.95
Indeno(1,2,3-cd)pyrene	4		0%			5.00
Isophorone	4		0%			5.00
N-Nitroso-di-n-propylamine	4		0%			5.00
N-Nitrosodiphenylamine	4		0%			2.50
Naphthalene	4		0%			5.00
Nitrobenzene	4		0%			1.75
Pentachlorophenol	4		0%			2.50
Phenanthrene	4		0%			5.00
Phenol	4		0%			5.00
Pyrene	4		0%			5.00

Appendix C-1

Reference Area Surface Water Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
VOCs, ug/l						
1,1,1-Trichloroethane	4		0%			2.5
1,1,2,2-Tetrachloroethane	4		0%			2.5
1,1,2-Trichloroethane	4		0%			2.5
1,1-Dichloroethane	4		0%			2.5
1,1-Dichloroethene	4		0%			2.5
1,2-Dichloroethane	4		0%			2.5
1,2-Dichloropropane	4		0%			2.5
2-Butanone (MEK)	4		0%			12.5
2-Hexanone	4		0%			12.5
4-Methyl-2-pentanone (MIBK)	4		0%			12.5
Acetone	4	1	25%	38	38	28
Benzene	4		0%			0.6
Bromodichloromethane	4		0%			2.5
Bromoform	4		0%			2.5
Bromomethane (Methyl bromide)	4		0%			4.9
Carbon disulfide	4		0%			2.5
Carbon tetrachloride	4		0%			2.5
Chlorobenzene	4		0%			2.5
Chloroethane	4		0%			5
Chloroform	4		0%			2.5
Chloromethane	4		0%			5
cis-1,3-Dichloropropene	4		0%			0.5
Cis/Trans-1,2-Dichloroethene	4		0%			2.5
Dibromochloromethane	4		0%			2.5
Ethylbenzene	4		0%			2.5
Methylene chloride	4		0%			2.35
Styrene	4		0%			2.5
Tetrachloroethene	4		0%			2.5
Toluene	4		0%			2.5
trans-1,3-Dichloropropene	4		0%			2.5
Trichloroethene	4		0%			1.35
Vinyl chloride	4		0%			5
Xylenes, Total	4		0%			2.5

Appendix C-1

Reference Area Surface Water Dioxin Data Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dioxins and Furans, ug/l						
1,2,3,4,6,7,8,9-OCDD	4	4	100%	0.00288	0.0074	0.00475625
1,2,3,4,6,7,8,9-OCDF	4	3	75%	0.000123	0.0001955	0.0001189
1,2,3,4,6,7,8-HpCDD	4	4	100%	0.0000959	0.000183	0.000143225
1,2,3,4,6,7,8-HpCDF	4	4	100%	0.0000147	0.0000445	0.000030225
1,2,3,4,7,8,9-HpCDF	4	1	25%	0.0000119	0.0000119	0.000005925
1,2,3,4,7,8-HxCDD	4	2	50%	0.00000575	0.000008	0.000004625
1,2,3,4,7,8-HxCDF	4		0%			0.0000032
1,2,3,6,7,8-HxCDD	4	3	75%	0.000009	0.0000098	7.5125E-06
1,2,3,6,7,8-HxCDF	4	2	50%	0.0000053	0.0000072	4.04375E-06
1,2,3,7,8,9-HxCDD	4	3	75%	0.0000109	0.0000139	0.000010025
1,2,3,7,8,9-HxCDF	4	3	75%	0.0000075	0.0000127	0.00000795
1,2,3,7,8-PeCDD	4	2	50%	0.0000083	0.0000087	5.31875E-06
1,2,3,7,8-PeCDF	4	2	50%	0.0000068	0.0000071	4.79375E-06
2,3,4,6,7,8-HxCDF	4		0%			3.38125E-06
2,3,4,7,8-PeCDF	4	1	25%	0.0000059	0.0000059	3.2875E-06
2,3,7,8-TCDD	4		0%			1.6125E-06
2,3,7,8-TCDF	4	3	75%	0.0000054	0.00000835	0.0000057
Total HpCDD	4	4	100%	0.000202	0.0004035	0.000326875
Total HpCDF	4	2	50%	0.000081	0.0001515	7.80375E-05
Total HxCDD	4	2	50%	0.0000633	0.00006425	0.0000435
Total HxCDF	4	2	50%	0.0000216	0.0000368	2.86438E-05
Total PeCDD	4	1	25%	0.0000083	0.0000083	5.34375E-06
Total PeCDF	4	2	50%	0.000013	0.00001635	0.0000092
Total TCDD	4	3	75%	0.0000039	0.000017	0.00000735
Total TCDF	4	3	75%	0.0000054	0.000009	5.8625E-06

Appendix C-2
Sediment Summary Statistics for Dead Creek Section F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency Of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	6		0%			38
2,4,5-TP (Silvex)	6		0%			38
2,4-D	6	3	50%	8.8	23	38
2,4-DB	6		0%			38
Dalapon	6		0%			304
Dicamba	6		0%			89
Dichloroprop	6		0%			452
Dinoseb	6		0%			452
MCPA	6		0%			8,942
MCPP	6		0%			8,942
Pentachlorophenol	6		0%			64
Inorganics, mg/kg						
Aluminum	6	6	100%	7,800	17,000	13,300
Antimony	6	5	83%	1.5	4.7	2.7
Arsenic	6	6	100%	8.0	19	15
Barium	6	6	100%	150	420	287
Beryllium	6	6	100%	0.53	0.89	0.74
Cadmium	6	6	100%	1.6	47	12
Calcium	6	6	100%	11,000	17,000	13,167
Chromium	6	6	100%	18	38	25
Cobalt	6	6	100%	5.5	13	9.4
Copper	6	6	100%	36	410	159
Cyanide, Total	6		0%			0.83
Iron	6	6	100%	14,000	38,000	27,333
Lead	6	6	100%	34	320	114
Magnesium	6	6	100%	3,600	6,800	5,033
Manganese	6	6	100%	170	1,400	758
Mercury	6	6	100%	0.10	1.1	0.37
Molybdenum	6	6	100%	0.37	3.7	1.2
Nickel	6	6	100%	35	390	134
Potassium	6	6	100%	1,500	2,900	2,183
Selenium	*6*		*0%*			1.6
Silver	6	1	17%	0.79	0.79	1.5
Sodium	6		0%			113
Thallium	6		0%			1.6
Vanadium	6	6	100%	25	51	37
Zinc	6	6	100%	250	3,700	1,197
pH	6	6	100%	6.7	7.06	6.9
Total Organic Carbon (mg/kg dry weight)	6	6	100%	33,000	140,000	64,333
PCBs, ug/kg						
Decachlorobiphenyl	6		0%			56
Dichlorobiphenyl	6		0%			11
Heptachlorobiphenyl	6		0%			33
Hexachlorobiphenyl	6	2	33%	17	22	25
Monochlorobiphenyl	6		0%			11
Nonachlorobiphenyl	6		0%			56
Octachlorobiphenyl	6		0%			33
Pentachlorobiphenyl	6	2	33%	61	66	39
Tetrachlorobiphenyl	6		0%			22
Trichlorobiphenyl	6		0%			11
Total PCBs	6	2	33%	*83*	*83*	*46*
Pesticides, ug/kg						
4,4'-DDD	6	1	17%	3.8	3.8	9.8
4,4'-DDE	6	6	100%	1.1	11	4.6
4,4'-DDT	6	3	50%	1.1	4.5	7.7
Total DDT	6	6	100%	9.2	43	22
Aldrin	6	1	17%	4.1	4.1	5.4
Alpha Chlordane	6	6	100%	0.48	5.3	2.6
alpha-BHC	6		0%			1.6
beta-BHC	6		0%			1.6
delta-BHC	6	1	17%	0.34	0.34	1.5

Appendix C-2
Sediment Summary Statistics for Dead Creek Section F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency Of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dieldrin	6	4	67%	0.26	9.3	6.3
Endosulfan I	6	6	100%	1.0	5.7	2.9
Endosulfan II	6	3	50%	1.8	8.1	6.8
Endosulfan sulfate	6	3	50%	1.4	9.5	8.7
Endrin	6	2	33%	1.7	1.7	7.7
Endrin aldehyde	6	6	100%	1.2	14	5.2
Endrin ketone	6	4	67%	0.7	10	6.7
Gamma Chlordane	6	5	83%	0.74	17	5.9
gamma-BHC (Lindane)	6	1	17%	4.8	4.8	5.6
Heptachlor	6	1	17%	0.93	0.93	4.5
Heptachlor epoxide	6	3	50%	0.51	5.4	4.9
Methoxychlor	6	3	50%	7.3	24	30
Toxaphene	6		0%			535
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	6		0%			279
1,2-Dichlorobenzene	6		0%			279
1,3-Dichlorobenzene	6		0%			279
1,4-Dichlorobenzene	6		0%			279
2,2'-Oxybis(1-Chloropropane)	6		0%			279
2,4,5-Trichlorophenol	6		0%			279
2,4,6-Trichlorophenol	6		0%			279
2,4-Dichlorophenol	6		0%			279
2,4-Dinitrophenol	6		0%			1,400
2,4-Dinitrotoluene	6		0%			279
2,6-Dinitrotoluene	6		0%			279
2-Chloronaphthalene	6		0%			279
2-Chlorophenol	6		0%			279
2-Methylnaphthalene	6		0%			
2-Methylphenol (o-cresol)	6		0%			
2-Nitroaniline	6		0%			1,400
2-Nitrophenol	6		0%			279
3,3'-Dichlorobenzidine	6		0%			538
3-Methylphenol/4-Methylphenol	6		0%			279
3-Nitroaniline	6		0%			1,400
4,6-Dinitro-2-methylphenol	6		0%			1,400
4-Bromophenylphenyl ether	6		0%			279
4-Chloro-3-methylphenol	6		0%			279
4-Chloroaniline	6		0%			538
4-Chlorophenylphenyl ether	6		0%			279
4-Nitroaniline	6		0%			1,400
4-Nitrophenol	6		0%			1,400
Acenaphthene	6		0%			279
Acenaphthylene	6		0%			279
Anthracene	6		0%			279
Benzo(a)anthracene	6		0%			279
Benzo(a)pyrene	6		0%			148
Benzo(b)fluoranthene	6		0%			279
Benzo(g,h,i)perylene	6		0%			279
Benzo(k)fluoranthene	6		0%			279
bis(2-Chloroethoxy)methane	6		0%			279
bis(2-Chloroethyl)ether	6		0%			279
bis(2-Ethylhexyl)phthalate	6		0%			279
Butylbenzylphthalate	6		0%			279
Carbazole	6		0%			279
Chrysene	6	1	17%	74	74	258
Di-n-butylphthalate	6		0%			279
Di-n-octylphthalate	6		0%			279
Dibenzo(a,h)anthracene	6		0%			[illegible]
Dibenzofuran	6		0%			
Diethylphthalate	6		0%			279
Dimethylphthalate	6		0%			279

Appendix C-2
Sediment Summary Statistics for Dead Creek Section F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency Of Detection	Minimum Detected	Maximum Detected	Average Concentration
Fluoranthene	6	2	33%	120	130	236
Fluorene	6		0%			279
Hexachlorobenzene	6		0%			114
Hexachlorobutadiene	6		0%			279
Hexachlorocyclopentadiene	6		0%			279
Hexachloroethane	6		0%			279
Indeno(1,2,3-cd)pyrene	6		0%			279
Isophorone	6		0%			279
N-Nitroso-di-n-propylamine	6		0%			279
N-Nitrosodiphenylamine	6		0%			279
Naphthalene	6		0%			279
Nitrobenzene	6		0%			279
Pentachlorophenol	6		0%			1,400
Phenanthrene	6		0%			279
Phenol	6		0%			279
Pyrene	6		0%			279
Total PAHs	6	2	33%	120	130	236
VOCs, ug/kg						
1,1,1-Trichloroethane	6		0%			14
1,1,2,2-Tetrachloroethane	6		0%			14
1,1,2-Trichloroethane	6		0%			14
1,1-Dichloroethane	6		0%			14
1,1-Dichloroethene	6		0%			13
1,2-Dichloroethane	6		0%			14
1,2-Dichloropropane	6		0%			14
2-Butanone (MEK)	6		0%			67
2-Hexanone	6		0%			67
4-Methyl-2-pentanone (MIBK)	6		0%			67
Acetone	6		0%			138
Benzene	6		0%			14
Bromodichloromethane	6		0%			14
Bromoform	6		0%			14
Bromomethane (Methyl bromide)	6		0%			27
Carbon disulfide	6		0%			14
Carbon tetrachloride	6		0%			14
Chlorobenzene	6		0%			14
Chloroethane	6		0%			27
Chloroform	6		0%			14
Chloromethane	6		0%			27
cis-1,3-Dichloropropene	6		0%			11
Cis/Trans-1,2-Dichloroethene	6		0%			14
Dibromochloromethane	6		0%			14
Ethylbenzene	6	1	17%	11	11	13
Methylene chloride (Dichloromethane)	6		0%			14
Styrene	6		0%			14
Tetrachloroethene	6		0%			14
Toluene	6		0%			14
trans-1,3-Dichloropropene	6		0%			11
Trichloroethene	6		0%			14
Vinyl chloride	6		0%			27
Xylenes, Total	6		0%			14

Appendix C-2
Site Sediment Dioxin Summary Statistics Creek Sector F and Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Freq. Of Detection	Minimum Detected	Maximum Detected	Average Concen.
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	6	6	100%	8.63	88.43	36.0
1,2,3,4,6,7,8,9-OCDF	6	6	100%	0.235	32.61	11.4
1,2,3,4,6,7,8-HpCDD	6	6	100%	0.238	9.44	3.17
1,2,3,4,6,7,8-HpCDF	6	6	100%	0.0548	5.08	1.78
1,2,3,4,7,8,9-HpCDF	6	6	100%	0.006	0.32	0.117
1,2,3,4,7,8-HxCDD	6	5	83%	0.0024	0.0688	0.022
1,2,3,4,7,8-HxCDF	6	6	100%	0.00505	0.162	0.059
1,2,3,6,7,8-HxCDD	6	6	100%	0.00795	0.32	0.110
1,2,3,6,7,8-HxCDF	6	6	100%	0.00295	0.0719	0.026
1,2,3,7,8,9-HxCDD	6	6	100%	0.00975	0.221	0.070
1,2,3,7,8,9-HxCDF	6	6	100%	0.00074	0.0223	0.008
1,2,3,7,8-PeCDD	6	6	100%	0.0021	0.0389	0.014
1,2,3,7,8-PeCDF	6	4	67%	0.0015	0.0124	0.008
2,3,4,6,7,8-HxCDF	6	6	100%	0.0035	0.0899	0.034
2,3,4,7,8-PeCDF	6	6	100%	0.0029	0.0333	0.013
2,3,7,8-TCDD	6	6	100%	0.0009	0.016	0.008
2,3,7,8-TCDF	6	6	100%	0.0062	0.0448	0.019
Total HpCDD	6	6	100%	0.541	17.9	6.11
Total HpCDF	6	5	83%	0.183	21.65	7.50
Total HxCDD	6	1	17%	1.37	1.37	0.592
Total HxCDF	6		0%			0.528
Total PeCDD	6		0%			0.142
Total PeCDF	6		0%			0.120
Total TCDD	6		0%			0.116
Total TCDF	6		0%			0.179

Appendix C-2

Sediment Summary Statistics for Dead Creek Sector F
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T (ug/kg)	3		0%			63
2,4,5-TP (Silvex)	3		0%			63
2,4-D	3	1	33%	23	23	66
2,4-DB	3		0%			63
Dalapon	3		0%			517
Dicamba	3		0%			151
Dichloroprop	3		0%			762
Dinoseb	3		0%			762
MCPA	3		0%			15067
MCPP	3		0%			15067
Pentachlorophenol	3		0%			104
Metals, mg/kg						
Aluminum	3	3	100%	7800	17000	12933
Antimony	3	3	100%	2.5	4.7	3.27
Arsenic	3	3	100%	8	19	14
Barium	3	3	100%	150	270	223
Beryllium	3	3	100%	0.53	0.89	0.76
Cadmium	3	3	100%	7.4	47	23
Calcium	3	3	100%	11000	13000	11667
Chromium	3	3	100%	19	38	29
Cobalt	3	3	100%	5.5	13	9.83
Copper	3	3	100%	160	410	270
Cyanide, Total	3		0%			0.95
Iron	3	3	100%	14000	26000	20667
Lead	3	3	100%	110	320	180
Magnesium	3	3	100%	4100	6800	5400
Manganese	3	3	100%	170	510	303
Mercury	3	3	100%	0.3	1.1	0.62
Molybdenum	3	3	100%	0.7	3.7	1.72
Nickel	3	3	100%	90	390	220
Potassium	3	3	100%	1600	2900	2400
Selenium	3		0%			1.80
Silver	3		0%			1.80
Sodium	3		0%			132
Thallium	3		0%			1.80
Vanadium	3	3	100%	25	51	39
Zinc	3	3	100%	950	3700	2083
pH	3	3	100%	6.71	6.87	6.81
Total Organic Carbon	3	3	100%	40000	140000	80333
PCB, ug/kg						
Decachlorobiphenyl (ug/kg)	3		0%			73
Dichlorobiphenyl	3		0%			14
Heptachlorobiphenyl	3		0%			43
Hexachlorobiphenyl	3	2	67%	17	22	33
Monochlorobiphenyl	3		0%			14
Nonachlorobiphenyl	3		0%			73
Octachlorobiphenyl	3		0%			43
Pentachlorobiphenyl	3	2	67%	61	66	62
Tetrachlorobiphenyl	3		0%			29
Trichlorobiphenyl	3		0%			14
Total PCBs	3	2	67%	83	120	75
Pesticides, ug/kg						
4,4'-DDD (ug/kg)	3	1	33%	3.8	3.8	11
4,4'-DDE	3	3	100%	2.5	11	7.20
4,4'-DDT	3	1	33%	4.5	4.5	11
Total DDT	3	3	100%	19	43	30
Aldrin	3	1	33%	4.1	4.1	6.37
Alpha Chlordane	3	3	100%	0.84	5.3	3.58
alpha-BHC	3		0%			1.88
beta-BHC	3		0%			1.88
delta-BHC	3	1	33%	0.34	0.34	1.61
Dieldrin	3	2	67%	0.99	9.3	9.26
Endosulfan I	3	3	100%	1.2	5.7	2.97
Endosulfan II	3	3	100%	1.8	8.1	5.13
Endosulfan sulfate	3	1	33%	2.8	2.8	11
Endrin	3	2	67%	1.7	1.7	6.97
Endrin aldehyde	3	3	100%	3.6	14	8.87
Endrin ketone	3	3	100%	3.8	10	7.00
Gamma Chlordane	3	3	100%	2.4	17	8.97
gamma-BHC (Lindane)	3		0%			6.30
Heptachlor	3	1	33%	0.93	0.93	4.61
Heptachlor epoxide	3	2	67%	0.51	5.4	4.97
Methoxychlor	3	3	100%	7.3	24	15
Toxaphene	3		0%			630
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	3		0%			318
1,2-Dichlorobenzene	3		0%			318
1,3-Dichlorobenzene	3		0%			318
1,4-Dichlorobenzene	3		0%			318
2,2'-Oxybis(1-Chloropropane)	3		0%			318
2,4,5-Trichlorophenol	3		0%			318
2,4,6-Trichlorophenol	3		0%			318

Appendix C-2

Sediment Summary Statistics for Dead Creek Sector F
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
2,4-Dichlorophenol	3		0%			318
2,4-Dinitrophenol	3		0%			1600
2,4-Dinitrotoluene	3		0%			318
2,6-Dinitrotoluene	3		0%			318
2-Chloronaphthalene	3		0%			318
2-Chlorophenol	3		0%			318
2-Methylnaphthalene	3		0%			318
2-Methylphenol (o-cresol)	3		0%			318
2-Nitroaniline	3		0%			1600
2-Nitrophenol	3		0%			318
3,3'-Dichlorobenzidine	3		0%			612
3-Methylphenol/4-Methylphenol	3		0%			318
3-Nitroaniline	3		0%			1600
4,6-Dinitro-2-methylphenol	3		0%			1600
4-Bromophenylphenyl ether	3		0%			318
4-Chloro-3-methylphenol	3		0%			318
4-Chloroaniline	3		0%			612
4-Chlorophenylphenyl ether	3		0%			318
4-Nitroaniline	3		0%			1600
4-Nitrophenol	3		0%			1600
Acenaphthene	3		0%			318
Acenaphthylene	3		0%			318
Anthracene	3		0%			318
Benzo(a)anthracene	3		0%			318
Benzo(a)pyrene	3		0%			168
Benzo(b)fluoranthene	3		0%			318
Benzo(g,h,i)perylene	3		0%			318
Benzo(k)fluoranthene	3		0%			318
bis(2-Chloroethoxy)methane	3		0%			318
bis(2-Chloroethyl)ether	3		0%			318
bis(2-Ethylhexyl)phthalate	3		0%			318
Butylbenzylphthalate	3		0%			318
Carbazole	3		0%			318
Chrysene	3	1	33%	74	74	276
Di-n-butylphthalate	3		0%			318
Di-n-octylphthalate	3		0%			318
Dibenzo(a,h)anthracene	3		0%			168
Dibenzofuran	3		0%			318
Diethylphthalate	3		0%			318
Dimethylphthalate	3		0%			318
Fluoranthene	3	2	67%	120	130	232
Fluorene	3		0%			318
Hexachlorobenzene	3		0%			132
Hexachlorobutadiene	3		0%			318
Hexachlorocyclopentadiene	3		0%			318
Hexachloroethane	3		0%			318
Indeno(1,2,3-cd)pyrene	3		0%			318
Isophorone	3		0%			318
N-Nitroso-di-n-propylamine	3		0%			318
N-Nitrosodiphenylamine	3		0%			318
Naphthalene	3		0%			318
Nitrobenzene	3		0%			318
Pentachlorophenol	3		0%			1600
Phenanthrene	3		0%			318
Phenol	3		0%			318
Pyrene	3		0%			318
Total PAHs	3	2	67%	120	130	230
VOCs, ug/kg						
1,1,1-Trichloroethane	3		0%			14
1,1,2,2-Tetrachloroethane	3		0%			14
1,1,2-Trichloroethane	3		0%			14
1,1-Dichloroethane	3		0%			14
1,1-Dichloroethene	3		0%			13
1,2-Dichloroethane	3		0%			14
1,2-Dichloropropane	3		0%			14
2-Butanone (MEK)	3		0%			69
2-Hexanone	3		0%			69
4-Methyl-2-pentanone (MIBK)	3		0%			69
Acetone	3		0%			145
Benzene	3		0%			14
Bromodichloromethane	3		0%			14
Bromoform	3		0%			14
Bromomethane (Methyl bromide)	3		0%			28
Carbon disulfide	3		0%			14
Carbon tetrachloride	3		0%			14
Chlorobenzene	3		0%			14
Chloroethane	3		0%			28
Chloroform	3		0%			14
Chloromethane	3		0%			28
cis-1,3-Dichloropropene	3		0%			11
Cis/Trans-1,2-Dichloroethene	3		0%			14

Appendix C-2

Sediment Summary Statistics for Dead Creek Sector F
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dibromochloromethane	3		0%			14
Ethylbenzene	3	1	33%	11	11	13
Methylene chloride (Dichloromethane)	3		0%			14
Styrene	3		0%			14
Tetrachloroethene	3		0%			14
Toluene	3		0%			14
trans-1,3-Dichloropropene	3		0%			11
Trichloroethene	3		0%			14
Vinyl chloride	3		0%			28
Xylenes, Total	3		0%			14

Appendix C-2

Sediment Dioxin Data Summary for Dead Creek Sector F
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	38.7	88.43	58.16333333
1,2,3,4,6,7,8,9-OCDF	3	3	100%	15.01	32.61	22.29333333
1,2,3,4,6,7,8-HpCDD	3	3	100%	4.03	9.44	5.97
1,2,3,4,6,7,8-HpCDF	3	3	100%	2.38	5.08	3.453333333
1,2,3,4,7,8,9-HpCDF	3	3	100%	0.157	0.32	0.225
1,2,3,4,7,8-HxCDD	3	3	100%	0.0228	0.0688	0.040233333
1,2,3,4,7,8-HxCDF	3	3	100%	0.0842	0.162	0.1112
1,2,3,6,7,8-HxCDD	3	3	100%	0.141	0.32	0.206666667
1,2,3,6,7,8-HxCDF	3	3	100%	0.0325	0.0719	0.047033333
1,2,3,7,8,9-HxCDD	3	3	100%	0.0667	0.221	0.126266667
1,2,3,7,8,9-HxCDF	3	3	100%	0.0085	0.0223	0.0139
1,2,3,7,8-PeCDD	3	3	100%	0.0145	0.0389	0.025533333
1,2,3,7,8-PeCDF	3	2	67%	0.0118	0.0124	0.013616667
2,3,4,6,7,8-HxCDF	3	3	100%	0.0473	0.0899	0.0625
2,3,4,7,8-PeCDF	3	3	100%	0.0147	0.0333	0.021966667
2,3,7,8-TCDD	3	3	100%	0.0055	0.016	0.009933333
2,3,7,8-TCDF	3	3	100%	0.016	0.0448	0.0304
Total HpCDD	3	3	100%	7.86	17.9	11.43
Total HpCDF	3	3	100%	10.65	21.65	14.64
Total HxCDD	3	1	33%	1.37	1.37	1.113333333
Total HxCDF	3		0%			1.006666667
Total PeCDD	3		0%			0.259833333
Total PeCDF	3		0%			0.220666667
Total TCDD	3		0%			0.2075
Total TCDF	3		0%			0.317166667

Appendix C-2
Sediment Data Summary for Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Freq. Of Detection	Minimum Detected	Maximum Detected	Average Concen.
Herbicides, ug/kg						
2,4,5-T	3		0%			12
2,4,5-TP (Silvex)	3		0%			12
2,4-D	3	2	67%	8.8	11	11
2,4-DB	3		0%			12
Dalapon	3		0%			92
Dicamba	3		0%			28
Dichloroprop	3		0%			142
Dinoseb	3		0%			142
MCPA	3		0%			2,817
MCPP	3		0%			2,817
Pentachlorophenol	3		0%			24
Metals, mg/kg						
Aluminum	3	3	100%	11,000	16,000	13,667
Antimony	3	2	67%	1.5	2.2	2.2
Arsenic	3	3	100%	13	17	16
Barium	3	3	100%	240	420.00	350
Beryllium	3	3	100%	0.58	0.82	0.71
Cadmium	3	3	100%	1.6	2.7	2.1
Calcium	3	3	100%	11,000	17,000	14,667
Chromium	3	3	100%	18	26	22
Cobalt	3	3	100%	7.1	10	8.9
Copper	3	3	100%	36	64	49
Cyanide, Total	3		0%			0.72
Iron	3	3	100%	28,000	38,000	34,000
Lead	3	3	100%	34	58	48
Magnesium	3	3	100%	3,600	5,600	4,667
Manganese	3	3	100%	940	1,400	1,213
Mercury	*3*	*3*	*100%*	*0.10*	*0.16*	*0.12*
Molybdenum	3	3	100%	0.37	0.92	0.60
Nickel	3	3	100%	35	54	47
Potassium	3	3	100%	1,500	2,200	1,967
Selenium	3		0%			1.4
Silver	3	1	33%	0.79	0.79	1.1
Sodium	3		0%			93
Thallium	3		0%			1.4
Vanadium	3	3	100%	28	40	35
Zinc	3	3	100%	250	370	310
pH	3	3	100%	6.7	7.1	6.9
Total Organic Carbon (mg/kg dry weight)	3	3	100%	33,000	67,000	48,333
PCB, ug/kg						
Decachlorobiphenyl	3		0%			39
Dichlorobiphenyl	3		0%			7.8
Heptachlorobiphenyl	3		0%			24
Hexachlorobiphenyl	3		0%			16
Monochlorobiphenyl	3		0%			7.8
Nonachlorobiphenyl	3		0%			39
Octachlorobiphenyl	3		0%			24
Pentachlorobiphenyl	3		0%			16
Tetrachlorobiphenyl	3		0%			16
Trichlorobiphenyl	3		0%			7.8
Total PCBs	3		0%			16
Pesticides, ug/kg						
4,4'-DDD	3		0%			8.5
4,4'-DDE	3	3	100%	1.1	3.2	2.0
4,4'-DDT	3	2	67%	1.1	1.4	4.0
Total DDT	3	3	100%	2.2	22	9.1

Appendix C-2
Sediment Data Summary for Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Freq. Of Detection	Minimum Detected	Maximum Detected	Average Concen.
Aldrin	3		0%			4.4
Alpha Chlordane	3	3	100%	0.48	3.2	1.6
alpha-BHC	3		0%			1.3
beta-BHC	3		0%			1.3
delta-BHC	3		0%			1.3
Dieldrin	3	2	67%	0.26	0.50	3.3
Endosulfan I	3	3	100%	1.00	4.90	2.9
Endosulfan II	3		0%			8.5
Endosulfan sulfate	3	2	67%	1.4	9.5	6.6
Endrin	3		0%			8.5
Endrin aldehyde	3	3	100%	1.2	2.2	1.6
Endrin ketone	3	1	33%	0.72	0.72	6.4
Gamma Chlordane	3	2	67%	0.74	3.0	2.8
gamma-BHC (Lindane)	3	1	33%	4.8	4.8	4.8
Heptachlor	3		0%			4.4
Heptachlor epoxide	3	1	33%	4.8	4.8	4.8
Methoxychlor	3		0%			44
Toxaphene	3		0%			440
1,2,4-Trichlorobenzene	3		0%			240
1,2-Dichlorobenzene	3		0%			240
1,3-Dichlorobenzene	3		0%			240
1,4-Dichlorobenzene	3		0%			240
2,2'-Oxybis(1-Chloropropane)	3		0%			240
2,4,5-Trichlorophenol	3		0%			240
2,4,6-Trichlorophenol	3		0%			240
2,4-Dichlorophenol	3		0%			240
2,4-Dinitrophenol	3		0%			1,200
2,4-Dinitrotoluene	3		0%			240
2,6-Dinitrotoluene	3		0%			240
2-Chloronaphthalene	3		0%			240
2-Chlorophenol	3		0%			240
2-Methylnaphthalene	3		0%			240
2-Methylphenol (o-cresol)	3		0%			240
2-Nitroaniline	3		0%			1,200
2-Nitrophenol	3		0%			240
3,3'-Dichlorobenzidine	3		0%			463
3-Methylphenol/4-Methylphenol	3		0%			240
3-Nitroaniline	3		0%			1,200
4,6-Dinitro-2-methylphenol	3		0%			1,200
4-Bromophenylphenyl ether	3		0%			240
4-Chloro-3-methylphenol	3		0%			240
4-Chloroaniline	3		0%			463
4-Chlorophenylphenyl ether	3		0%			240
4-Nitroaniline	3		0%			1,200
4-Nitrophenol	3		0%			1,200
Acenaphthene	3		0%			240
Acenaphthylene	3		0%			240
Anthracene	3		0%			240
Benzo(a)anthracene	3		0%			240
Benzo(a)pyrene	3		0%			127
Benzo(b)fluoranthene	3		0%			240
Benzo(g,h,i)perylene	3		0%			240
Benzo(k)fluoranthene	3		0%			240
bis(2-Chloroethoxy)methane	3		0%			240
bis(2-Chloroethyl)ether	3		0%			240
bis(2-Ethylhexyl)phthalate	3		0%			240
Butylbenzylphthalate	3		0%			240
Carbazole	3		0%			240
Chrysene	3		0%			240
Di-n-butylphthalate	3		0%			240
Di-n-octylphthalate	3		0%			240
Dibenzo(a,h)anthracene	3		0%			127
Dibenzofuran	3		0%			240
Diethylphthalate	3		0%			240
Dimethylphthalate	3		0%			240
Fluoranthene	3		0%			240
Fluorene	3		0%			240
Hexachlorobenzene	3		0%			97
Hexachlorobutadiene	3		0%			240

Appendix C-2
Sediment Data Summary for Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Freq. Of Detection	Minimum Detected	Maximum Detected	Average Concen.
Hexachlorocyclopentadiene	3		0%			240
Hexachloroethane	3		0%			240
Indeno(1,2,3-cd)pyrene	3		0%			240
Isophorone	3		0%			240
N-Nitroso-di-n-propylamine	3		0%			240
N-Nitrosodiphenylamine	3		0%			240
Naphthalene	3		0%			240
Nitrobenzene	3		0%			240
Pentachlorophenol	3		0%			1,200
Phenanthrene	3		0%			240
Phenol	3		0%			240
Pyrene	3		0%			240
Total PAHs	3		0%			240
VOCs, ug/kg						
1,1,1-Trichloroethane	3		0%			13
1,1,2,2-Tetrachloroethane	3		0%			13
1,1,2-Trichloroethane	3		0%			13
1,1-Dichloroethane	3		0%			13
1,1-Dichloroethene	3		0%			12
1,2-Dichloroethane	3		0%			13
1,2-Dichloropropane	3		0%			13
2-Butanone (MEK)	3		0%			65
2-Hexanone	3		0%			65
4-Methyl-2-pentanone (MIBK)	3		0%			65
Acetone	3		0%			130
Benzene	3		0%			13
Bromodichloromethane	3		0%			13
Bromoform	3		0%			13
Bromomethane (Methyl bromide)	3		0%			26
Carbon disulfide	3		0%			13
Carbon tetrachloride	3		0%			13
Chlorobenzene	3		0%			13
Chloroethane	3		0%			26
Chloroform	3		0%			13
Chloromethane	3		0%			26
cis-1,3-Dichloropropene	3		0%			10
Cis/Trans-1,2-Dichloroethene	3		0%			13
Dibromochloromethane	3		0%			13
Ethylbenzene	3		0%			13
Methylene chloride (Dichloromethane)	3		0%			13
Styrene	3		0%			13
Tetrachloroethene	3		0%			13
Toluene	3		0%			13
trans-1,3-Dichloropropene	3		0%			10
Trichloroethene	3		0%			13
Vinyl chloride	3		0%			26
Xylenes, Total	3		0%			13

Appendix C-2
Sediment Dioxin Summary for Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Freq. Of Detection	Minimum Detected	Maximum Detected	Average Concen.
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	8.63	17.25	13.79
1,2,3,4,6,7,8,9-OCDF	3	3	100%	0.24	0.76	0.55
1,2,3,4,6,7,8-HpCDD	3	3	100%	0.24	0.44	0.37
1,2,3,4,6,7,8-HpCDF	3	3	100%	0.05	0.16	0.11
1,2,3,4,7,8,9-HpCDF	3	3	100%	0.01	0.01	0.01
1,2,3,4,7,8-HxCDD	3	2	67%	0.0024	0.0049	0.0031
1,2,3,4,7,8-HxCDF	3	3	100%	0.01	0.0092	0.01
1,2,3,6,7,8-HxCDD	3	3	100%	0.01	0.02	0.01
1,2,3,6,7,8-HxCDF	3	3	100%	0.0030	0.0059	0.0043
1,2,3,7,8,9-HxCDD	3	3	100%	0.01	0.02	0.01
1,2,3,7,8,9-HxCDF	3	3	100%	0.00074	0.0036	0.0025
1,2,3,7,8-PeCDD	3	3	100%	0.0021	0.0035	0.0026
1,2,3,7,8-PeCDF	3	2	67%	0.0015	0.0027	0.0017
2,3,4,6,7,8-HxCDF	3	3	100%	0.0035	0.0073	0.01
2,3,4,7,8-PeCDF	3	3	100%	0.0029	0.0042	0.0037
2,3,7,8-TCDD	3	3	100%	0.00090	0.01	0.01
2,3,7,8-TCDF	3	3	100%	0.01	0.01	0.01
Total HpCDD	3	3	100%	0.54	0.93	0.80
Total HpCDF	3	2	67%	0.18	0.60	0.35
Total HxCDD	3		0%			0.07
Total HxCDF	3		0%			0.05
Total PeCDD	3		0%			0.02
Total PeCDF	3		0%			0.02
Total TCDD	3		0%			0.02
Total TCDF	3		0%			0.04

Appendix C-2

Reference Area Sediment Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	4		0%			9.00
2,4,5-TP (Silvex)	4		0%			9.00
2,4-D	4	1	25%	12	12	10
2,4-DB	4		0%			9 00
Dalapon	4		0%			69
Dicamba	4		0%			22
Dichloroprop	4		0%			110
Dinoseb	4		0%			110
MCPA	4		0%			2175
MCPP	4		0%			2175
Pentachlorophenol	4	1	25%	1.9	1.9	15
Metals, mg/kg						
Aluminum	4	4	100%	12000	19000	14500
Antimony	4	3	75%	1.3	4	2.10
Arsenic	4	4	100%	6 7	8	7.18
Barium	4	4	100%	170	230	208
Beryllium	4	4	100%	0 62	1	0.78
Cadmium	4	4	100%	0.29	0.65	0.42
Calcium	4	4	100%	12000	18000	13500
Chromium	4	4	100%	17	25	20
Cobalt	4	4	100%	7.1	10	8.60
Copper	4	4	100%	16	23	19
Cyanide, Total	4		0%			0.55
Iron	4	4	100%	18000	24000	20750
Lead	4	4	100%	17	26	22
Magnesium	4	4	100%	3300	6500	5150
Manganese	4	4	100%	570	770	708
Mercury	4	4	100%	0.04	0.063	0.05
Molybdenum	4	4	100%	0.37	0.53	0.45
Nickel	4	4	100%	18	26	22
Potassium	4	4	100%	1600	2600	2100
Selenium	4		0%			1.03
Silver	4		0%			1.03
Sodium	4		0%			85
Thallium	4		0%			1.03
Vanadium	4	4	100%	30	44	35
Zinc	4	4	100%	59	96	83
pH	4	4	100%	6.8	7.31	7.07
Total Organic Carbon	4	4	100%	12000	23000	17000
PCB, ug/kg						
Decachlorobiphenyl	4		0%			18
Dichlorobiphenyl	4		0%			3.60
Heptachlorobiphenyl	4		0%			11
Hexachlorobiphenyl	4		0%			7.25
Monochlorobiphenyl	4		0%			3.60
Nonachlorobiphenyl	4		0%			18.3
Octachlorobiphenyl	4		0%			11
Pentachlorobiphenyl	4		0%			7.25
Tetrachlorobiphenyl	4		0%			7.25
Trichlorobiphenyl	4		0%			3.60
Total PCBs	4		0%			7.30
Pesticides, ug/kg						
4,4'-DDD	4		0%			3.58
4,4'-DDE	4		0%			3.58
4,4'-DDT	4		0%			3 58
Aldrin	4		0%			1.85
Alpha Chlordane	4		0%			1.85
alpha-BHC	4		0%			0.54
beta-BHC	4		0%			0.54
delta-BHC	4		0%			0.54
Dieldrin	4		0%			3.58
Endosulfan I	4		0%			1.85
Endosulfan II	4		0%			3.58
Endosulfan sulfate	4		0%			3.58
Endrin	4		0%			3.58
Endrin aldehyde	4		0%			3.58
Endrin ketone	4		0%			3.58
Gamma Chlordane	4		0%			1.85
gamma-BHC (Lindane)	4		0%			1.85
Heptachlor	4		0%			1.85
Heptachlor epoxide	4		0%			1.85
Methoxychlor	4		0%			19
Toxaphene	4		0%			185

Appendix C-2

Reference Area Sediment Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	4		0%			184
1,2-Dichlorobenzene	4		0%			184
1,3-Dichlorobenzene	4		0%			184
1,4-Dichlorobenzene	4		0%			184
2,2'-Oxybis(1-Chloropropane)	4		0%			184
2,4,5-Trichlorophenol	4		0%			184
2,4,6-Trichlorophenol	4		0%			184
2,4-Dichlorophenol	4		0%			184
2,4-Dinitrophenol	4		0%			925
2,4-Dinitrotoluene	4		0%			184
2,6-Dinitrotoluene	4		0%			184
2-Chloronaphthalene	4		0%			184
2-Chlorophenol	4		0%			184
2-Methylnaphthalene	4		0%			184
2-Methylphenol (o-cresol)	4		0%			184
2-Nitroaniline	4		0%			925
2-Nitrophenol	4		0%			184
3,3'-Dichlorobenzidine	4		0%			359
3-Methylphenol/4-Methylphenol	4		0%			184
3-Nitroaniline	4		0%			925
4,6-Dinitro-2-methylphenol	4		0%			925
4-Bromophenylphenyl ether	4		0%			184
4-Chloro-3-methylphenol	4		0%			184
4-Chloroaniline	4		0%			359
4-Chlorophenylphenyl ether	4		0%			184
4-Nitroaniline	4		0%			925
4-Nitrophenol	4		0%			925
Acenaphthene	4		0%			184
Acenaphthylene	4		0%			184
Anthracene	4		0%			184
Benzo(a)anthracene	4		0%			184
Benzo(a)pyrene	4		0%			96
Benzo(b)fluoranthene	4		0%			184
Benzo(g,h,i)perylene	4		0%			184
Benzo(k)fluoranthene	4		0%			184
bis(2-Chloroethoxy)methane	4		0%			184
bis(2-Chloroethyl)ether	4		0%			184
bis(2-Ethylhexyl)phthalate	4		0%			184
Butylbenzylphthalate	4		0%			184
Carbazole	4		0%			184
Chrysene	4		0%			184
Di-n-butylphthalate	4		0%			184
Di-n-octylphthalate	4		0%			184
Dibenzo(a,h)anthracene	4		0%			96
Dibenzofuran	4		0%			184
Diethylphthalate	4		0%			184
Dimethylphthalate	4		0%			184
Fluoranthene	4		0%			184
Fluorene	4		0%			184
Hexachlorobenzene	4		0%			75
Hexachlorobutadiene	4		0%			184
Hexachlorocyclopentadiene	4		0%			184
Hexachloroethane	4		0%			184
Indeno(1,2,3-cd)pyrene	4		0%			184
Isophorone	4		0%			184
N-Nitroso-di-n-propylamine	4		0%			184
N-Nitrosodiphenylamine	4		0%			184
Naphthalene	4		0%			184
Nitrobenzene	4		0%			184
Pentachlorophenol	4		0%			925
Phenanthrene	4		0%			184
Phenol	4		0%			184
Pyrene	4		0%			184
Total PAHs						
VOCs, ug/kg						
1,1,1-Trichloroethane	4		0%			6.56
1,1,2,2-Tetrachloroethane	4		0%			6.56
1,1,2-Trichloroethane	4		0%			6.56
1,1-Dichloroethane	4		0%			6.56
1,1-Dichloroethene	4		0%			5.96
1,2-Dichloroethane	4		0%			6.56
1,2-Dichloropropane	4		0%			6.56
2-Butanone (MEK)	4	3	75%	14	40	25
2-Hexanone	4		0%			33
4-Methyl-2-pentanone (MIBK)	4		0%			33
Acetone	4	3	75%	52	160	78
Benzene	4		0%			6.56
Bromodichloromethane	4		0%			6.56
Bromoform	4		0%			6.56
Bromomethane (Methyl bromide)	4		0%			13
Carbon disulfide	4		0%			6.56
Carbon tetrachloride	4		0%			6.56
Chlorobenzene	4		0%			6.56
Chloroethane	4		0%			13
Chloroform	4		0%			6.56
Chloromethane	4		0%			13
cis-1,3-Dichloropropene	4		0%			5.34
Cis/Trans-1,2-Dichloroethene	4		0%			6.56
Dibromochloromethane	4		0%			6.56
Ethylbenzene	4		0%			6.56
Methylene chloride (Dichloromethane)	4		0%			6.56
Styrene	4		0%			6.56
Tetrachloroethene	4		0%			6.56
Toluene	4		0%			6.56
trans-1,3-Dichloropropene	4		0%			5.34
Trichloroethene	4		0%			6.56
Vinyl chloride	4		0%			13
Xylenes, Total	4		0%			6.56

Appendix C-2

Reference Area Sediment Dioxin Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	4	4	100%	3.47	8.57	5.24
1,2,3,4,6,7,8,9-OCDF	4	4	100%	0.0143	0.136	0.0963
1,2,3,4,6,7,8-HpCDD	4	4	100%	0.128	0.162	0.146
1,2,3,4,6,7,8-HpCDF	4	4	100%	0.0059	0.0307	0.0226
1,2,3,4,7,8,9-HpCDF	4	1	25%	0.003	0.003	0.001
1,2,3,4,7,8-HxCDD	4	3	75%	0.0011	0.0022	0.0015
1,2,3,4,7,8-HxCDF	4	2	50%	0.0029	0.003	0.0019
1,2,3,6,7,8-HxCDD	4	4	100%	0.0033	0.0046	0.0041
1,2,3,6,7,8-HxCDF	4	1	25%	0.0013	0.0013	0.00061
1,2,3,7,8,9-HxCDD	4	4	100%	0.0034	0.0051	0.0044
1,2,3,7,8,9-HxCDF	4		0%			0.00011
1,2,3,7,8-PeCDD	4	2	50%	0.0013	0.0015	0.0010
1,2,3,7,8-PeCDF	4	1	25%	0.0011	0.0011	0.00045
2,3,4,6,7,8-HxCDF	4	2	50%	0.0016	0.0018	0.0010
2,3,4,7,8-PeCDF	4	1	25%	0.0013	0.0013	0.00066
2,3,7,8-TCDD	4	2	50%	0.00064	0.0035	0.0012
2,3,7,8-TCDF	4	4	100%	0.00076	0.0014	0.0012
Total HpCDD	4	4	100%	0.278	0.347	0.323
Total HpCDF	4	2	50%	0.0164	0.113	0.0581
Total HxCDD	4	1	25%	0.0458	0.0458	0.0288
Total HxCDF	4	3	75%	0.0062	0.0252	0.0165
Total PeCDD	4	1	25%	0.021	0.021	0.017
Total PeCDF	4		0%			0.0040
Total TCDD	4		0%			0.012
Total TCDF	4	2	50%	0.0068	0.0145	0.00914

Summary Statistics for Borrow Pit Lake Largemouth Bass
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	3		0%			5.00
2,4,5-TP (Silvex)	3		0%			5.00
2,4-D	3		0%			5.00
2,4-DB	3		0%			5.00
Dalapon	3		0%			1000
Dicamba	3	1	33%	1.9	1.9	5.63
Dichloroprop	3		0%			50
Dinoseb	3		0%			50
MCPA[(4-chloro-2-methylphenoxy)-	3	1	33%	1800	1800	1267
MCPP[2-(4-chloro-2-	3		0%			1000
Pentachlorophenol	3		0%			6.67
Metals, mg/kg						
Aluminum	3	2	67%	19	33	20
Antimony	3		0%			0.09
Arsenic	3		0%			3.17
Beryllium	3		0%			0.47
Cadmium	3		0%			0.23
Chromium	3	3	100%	0.45	0.93	0.64
Copper	3	3	100%	0.41	0.68	0.54
Cyanide, Total	3		0%			5
Lead	3		0%			0.23
Mercury	3	2	67%	0.057	0.064	0.04
Nickel	3		0%			4.70
Selenium	3	2	67%	0.6	0.63	0.49
Silver	3		0%			0.05
Zinc	3	3	100%	15	19	17
% Lipid	3	3	100%	1.5	1.8	1.60
PCB, ug/kg						
Decachlorobiphenyl	3		0%			25
Dichlorobiphenyl	3		0%			5.00
Heptachlorobiphenyl	3	2	67%	16	21	17
Hexachlorobiphenyl	3	3	100%	44	150	105
Monochlorobiphenyl	3		0%			5.00
Nonachlorobiphenyl	3		0%			25
Octachlorobiphenyl	3		0%			15
Pentachlorobiphenyl	3	3	100%	30	130	90
Tetrachlorobiphenyl	3	2	67%	19	46	25
Trichlorobiphenyl	3		0%			5.00
Total PCBs	3	3	100%	99	320	237
Pesticides, ug/kg						
4,4'-DDD	3		0%			6.50
4,4'-DDE	3	2	67%	15	21	14
4,4'-DDT	3		0%			6.50
Total DDT	3	2	67%	15	21	14
Aldrin	3		0%			3.40
Alpha Chlordane	3		0%			3.40
alpha-BHC	3		0%			3.40
beta-BHC	3		0%			3.40
delta-BHC	3		0%			3.40
Dieldrin	3		0%			6.50
Endosulfan I	3		0%			3.40
Endosulfan II	3		0%			6.50
Endosulfan sulfate	3		0%			6.50
Endrin	3		0%			6.50
Endrin aldehyde	3		0%			6.50
Endrin ketone	3		0%			6.50
Gamma Chlordane	3	2	67%	15	19	12
gamma-BHC (Lindane)	3		0%			3.40
Heptachlor	3	1	33%	1.5	1.5	2.77
Heptachlor epoxide	3		0%			3.40
Methoxychlor	3		0%			34
Toxaphene	3		0%			340
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	3		0%			85
1,2-Dichlorobenzene	3		0%			85
1,3-Dichlorobenzene	3		0%			85
1,4-Dichlorobenzene	3		0%			85
2,2'-Oxybis(1-chloropropane)(bis(2-	3		0%			85
2,4,5-Trichlorophenol	3		0%			210
2,4,6-Trichlorophenol	3		0%			85
2,4-Dichlorophenol	3		0%			85
2,4-Dimethylphenol	3		0%			85
2,4-Dinitrophenol	3		0%			210
2,4-Dinitrotoluene	3		0%			85
2,6-Dinitrotoluene	3		0%			85
2-Chloronaphthalene	3		0%			85
2-Chlorophenol	3		0%			85
2-Methyl-4,6-dinitrophenol	3		0%			210
2-Methylnaphthalene	3		0%			85
2-Methylphenol (o-cresol)	3		0%			85
2-Nitroaniline	3		0%			210
2-Nitrophenol	3		0%			85
3&4-Methylphenol (m&p-cresol)	3		0%			85
3,3'-Dichlorobenzidine	3		0%			85
3-Nitroaniline	3		0%			210
4-Bromophenylphenyl ether	3		0%			85
4-Chloro-3-methylphenol	3		0%			85
4-Chloroaniline	3		0%			85
4-Chlorophenylphenyl ether	3		0%			85

Appendix C-3

Summary Statistics for Borrow Pit Lake Largemouth Bass
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
4-Nitroaniline	3		0%			210
4-Nitrophenol	3		0%			210
Acenaphthene	3		0%			85
Acenaphthylene	3		0%			85
Anthracene	3		0%			85
Benzo(a)anthracene	3		0%			85
Benzo(a)pyrene	3		0%			85
Benzo(b)fluoranthene	3		0%			85
Benzo(g,h,i)perylene	3		0%			85
Benzo(k)fluoranthene	3		0%			85
bis(2-Chloroethoxy)methane	3		0%			85
bis(2-Chloroethyl)ether	3		0%			85
bis(2-Ethylhexyl)phthalate	3		0%			91.67
Butylbenzylphthalate	3		0%			85
Carbazole	3		0%			85
Chrysene	3		0%			85
Di-n-butylphthalate	3	1	33%	32	32	67.33
Di-n-octylphthalate	3		0%			85
Dibenzo(a,h)anthracene	3		0%			85
Dibenzofuran	3		0%			85
Diethylphthalate	3		0%			85
Dimethylphthalate	3		0%			85
Fluoranthene	3		0%			85
Fluorene	3		0%			85
Hexachlorobenzene	3		0%			85
Hexachlorobutadiene	3		0%			85
Hexachlorocyclopentadiene	3		0%			85
Hexachloroethane	3		0%			85
Indeno(1,2,3-cd)pyrene	3		0%			85
Isophorone	3		0%			85
n-Nitrosodi-n-propylamine	3		0%			85
N-	3		0%			85
Naphthalene	3		0%			85
Nitrobenzene	3		0%			85
Pentachlorophenol	3		0%			210
Phenanthrene	3		0%			85
Phenol	3		0%			85
Pyrene	3		0%			85
Total PAHs	3		0%			85
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	3		0%			0.006533333
1,2,3,4,6,7,8,9-OCDF	3		0%			0.00105
1,2,3,4,6,7,8-HpCDD	3		0%			0.000866667
1,2,3,4,6,7,8-HpCDF	3		0%			0.0001
1,2,3,4,7,8,9-HpCDF	3		0%			0.000166667
1,2,3,4,7,8-HxCDD	3		0%			0.00015
1,2,3,4,7,8-HxCDF	3	1	33%	0.00048	0.00048	0.000243333
1,2,3,6,7,8-HxCDD	3	1	33%	0.00054	0.00054	0.000293333
1,2,3,6,7,8-HxCDF	3	1	33%	0.00023	0.00023	0.000143333
1,2,3,7,8,9-HxCDD	3		0%			0.000133333
1,2,3,7,8,9-HxCDF	3		0%			0.0001
1,2,3,7,8-PeCDD	3	1	33%	0.00081	0.00081	0.000501667
1,2,3,7,8-PeCDF	3	1	33%	0.0011	0.0011	0.000396667
2,3,4,6,7,8-HxCDF	3	1	33%	0.00038	0.00038	0.00021
2,3,4,7,8-PeCDF	3	2	67%	0.00071	0.00097	0.000663333
2,3,7,8-TCDD	3	2	67%	0.00075	0.0009	0.000733333
2,3,7,8-TCDF	3	3	100%	0.0081	0.0114	0.009266667
Total HpCDD	3	2	67%	0.0014	0.002	0.001433333
Total HpCDF	3	1	33%	0.0067	0.0067	0.004366667
Total HxCDD	3	1	33%	0.00054	0.00054	0.00048
Total HxCDF	3		0%			0.01675
Total PeCDD	3	1	33%	0.00081	0.00081	0.000501667
Total PeCDF	3		0%			0.019083333
Total TCDD	3	1	33%	0.00075	0.00075	0.000583333
Total TCDF	3		0%			0.03045

Reference Area Largemouth Bass Data
Saugel Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	4		0%			5.00
2,4,5-TP (Silvex)	4		0%			5.00
2,4-D	4		0%			5.00
2,4-DB	4		0%			5.00
Dalapon	4		0%			1000
Dicamba	4		0%			10
Dichloroprop	4		0%			50
Dinoseb	4		0%			50
MCPA[(4-chloro-2-methylphenoxy)-acetic a	4		0%			1000
MCPP[2-(4-chloro-2-methylphenoxy)-propan	4		0%			1000
Pentachlorophenol	4		0%			6.25
Metals, mg/kg						
Aluminum	4	4	100%	22.00	81.00	41
Antimony	4		0%			0.09
Arsenic	4		0%			2.10
Beryllium	4		0%			0.46
Cadmium	4		0%			0.23
Chromium	4	4	100%	0.19	0.36	0.28
Copper	4	4	100%	0.36	0.84	0.52
Cyanide, Total	4		0%			5.00
Lead	4		0%			0.23
Mercury	4	4	100%	0.10	0.14	0.11
Nickel	4		0%			4.56
Selenium	4	3	75%	0.53	0.86	0.60
Silver	4		0%			0.05
Zinc	4	4	100%	8.50	15.00	11
% Lipid	4	4	100%	0.66	2.40	1.19
PCBs and Pesticides, ug/kg						
Decachlorobiphenyl	4		0%			25
Dichlorobiphenyl	4		0%			5.00
Heptachlorobiphenyl	4		0%			15
Hexachlorobiphenyl	4	1	25%	9.30	9.30	9.83
Monochlorobiphenyl	4		0%			5.00
Nonachlorobiphenyl	4		0%			25
Octachlorobiphenyl	4		0%			15
Pentachlorobiphenyl	4	1	25%	9.50	9.50	9.88
Tetrachlorobiphenyl	4		0%			10
Trichlorobiphenyl	4		0%			5.00
4,4'-DDD	4		0%			5.54
4,4'-DDE	4	4	100%	3.50	6.60	5.30
4,4'-DDT	4		0%			5.54
Aldrin	4		0%			2.89
Alpha Chlordane	4		0%			2.89
alpha-BHC	4		0%			2.89
beta-BHC	4		0%			2.89
delta-BHC	4		0%			2.89
Dieldrin	4	2	50%	5.30	5.60	5.01
Endosulfan I	4		0%			2.89
Endosulfan II	4		0%			5.54
Endosulfan sulfate	4		0%			5.54
Endrin	4		0%			5.54
Endrin aldehyde	4		0%			5.54
Endrin ketone	4		0%			5.54
Gamma Chlordane	4		0%			2.89
gamma-BHC (Lindane)	4		0%			2.89
Heptachlor	4		0%			2.89
Heptachlor epoxide	4		0%			2.89
Methoxychlor	4		0%			29
Toxaphene	4		0%			289
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	4		0%			85
1,2-Dichlorobenzene	4		0%			85
1,3-Dichlorobenzene	4		0%			85
1,4-Dichlorobenzene	4		0%			85
2,2'-Oxybis(1-chloropropane)(bis(2-Chlor	4		0%			85
2,4,5-Trichlorophenol	4		0%			210
2,4,6-Trichlorophenol	4		0%			85
2,4-Dichlorophenol	4		0%			85
2,4-Dimethylphenol	4		0%			85
2,4-Dinitrophenol	4		0%			210
2,4-Dinitrotoluene	4		0%			85
2,6-Dinitrotoluene	4		0%			85
2-Chloronaphthalene	4		0%			85
2-Chlorophenol	4		0%			85
2-Methyl-4,6-dinitrophenol	4		0%			210
2-Methylnaphthalene	4		0%			85
2-Methylphenol (o-cresol)	4		0%			85
2-Nitroaniline	4		0%			210
2-Nitrophenol	4		0%			85
3&4-Methylphenol (m&p-cresol)	4		0%			85
3,3'-Dichlorobenzidine	4		0%			85
3-Nitroaniline	4		0%			210
4-Bromophenylphenyl ether	4		0%			85
4-Chloro-3-methylphenol	4		0%			85
4-Chloroaniline	4		0%			85

Appendix C-3

Reference Area Largemouth Bass Data
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
4-Chlorophenylphenyl ether	4		0%			85
4-Nitroaniline	4		0%			210
4-Nitrophenol	4		0%			210
Acenaphthene	4		0%			85
Acenaphthylene	4		0%			85
Anthracene	4		0%			85
Benzo(a)anthracene	4		0%			85
Benzo(a)pyrene	4		0%			85
Benzo(b)fluoranthene	4		0%			85
Benzo(g,h,i)perylene	4		0%			85
Benzo(k)fluoranthene	4		0%			85
bis(2-Chloroethoxy)methane	4		0%			85
bis(2-Chloroethyl)ether	4		0%			85
bis(2-Ethylhexyl)phthalate	4		0%			85
Butylbenzylphthalate	4		0%			85
Carbazole	4		0%			85
Chrysene	4		0%			85
Di-n-butylphthalate	4	2	50%	19.00	20.00	52
Di-n-octylphthalate	4		0%			85
Dibenzo(a,h)anthracene	4		0%			85
Dibenzofuran	4		0%			85
Diethylphthalate	4		0%			85
Dimethylphthalate	4		0%			85
Fluoranthene	4		0%			85
Fluorene	4		0%			85
Hexachlorobenzene	4		0%			85
Hexachlorobutadiene	4		0%			85
Hexachlorocyclopentadiene	4		0%			85
Hexachloroethane	4		0%			85
Indeno(1,2,3-cd)pyrene	4		0%			85
Isophorone	4		0%			85
n-Nitrosodi-n-propylamine	4		0%			85
N-Nitrosodiphenylamine/Diphenylamine	4		0%			85
Naphthalene	4		0%			85
Nitrobenzene	4		0%			85
Pentachlorophenol	4		0%			210
Phenanthrene	4		0%			85
Phenol	4		0%			85
Pyrene	4		0%			85
Total PAHs						
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	4	4	100%	0.0055	0.0123	0.009725
1,2,3,4,6,7,8,9-OCDF	4		0%			0.0005375
1,2,3,4,6,7,8-HpCDD	4		0%			0.000425
1,2,3,4,6,7,8-HpCDF	4		0%			0.0002375
1,2,3,4,7,8,9-HpCDF	4		0%			0.0003875
1,2,3,4,7,8-HxCDD	4		0%			0.0002875
1,2,3,4,7,8-HxCDF	4	3	75%	0.00084	0.0011	0.000785
1,2,3,6,7,8-HxCDD	4		0%			0.0002375
1,2,3,6,7,8-HxCDF	4		0%			0.0001625
1,2,3,7,8,9-HxCDD	4		0%			0.0003125
1,2,3,7,8,9-HxCDF	4		0%			0.0002375
1,2,3,7,8-PeCDD	4		0%			0.000325
1,2,3,7,8-PeCDF	4		0%			0.0001875
2,3,4,6,7,8-HxCDF	4		0%			0.0002
2,3,4,7,8-PeCDF	4		0%			0.0001875
2,3,7,8-TCDD	4		0%			0.000225
2,3,7,8-TCDF	4	1	25%	0.0016	0.0016	0.0005375
Total HpCDD	4		0%			0.000425
Total HpCDF	4		0%			0.0018625
Total HxCDD	4		0%			0.0002875
Total HxCDF	4		0%			0.0096125
Total PeCDD	4		0%			0.000325
Total PeCDF	4		0%			0.016075
Total TCDD	4		0%			0.000225
Total TCDF	4		0%			0.019775

Appendix C-3

Brown Bullhead Data Summary for Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	3		0%			5.00
2,4,5-TP (Silvex)	3		0%			5.00
2,4-D	3		0%			5.00
2,4-DB	3		0%			5.00
Dalapon	3		0%			1000
Dicamba	3		0%			8.33
Dichloroprop	3	1	33%	6.6	6.6	36
Dinoseb	3		0%			50
MCPA[(4-chloro-2-methylphenoxy)-acetic a	3		0%			1000
MCPP[2-(4-chloro-2-methylphenoxy)-propan	3		0%			1000
Pentachlorophenol	3		0%			10
Metals, mg/kg						
Aluminum	3	3	100%	7.7	18	13
Antimony	3		0%			0.09
Arsenic	3		0%			1.43
Beryllium	3		0%			0.47
Cadmium	3		0%			0.23
Chromium	3	3	100%	0.27	0.70	0.42
Copper	3	3	100%	0.79	0.89	0.84
Cyanide, Total	3		0%			5.00
Lead	3	1	33%	0.25	0.25	0.24
Mercury	3	3	100%	0.05	0.26	0.13
Nickel	3		0%			4.70
Selenium	3		0%			0.23
Silver	3		0%			0.05
Zinc	3	3	100%	18	22	20
% Lipids	3	3	100%	0.30	1.70	1.13
PCB, ug/kg						
Decachlorobiphenyl	3		0%			25
Dichlorobiphenyl	3		0%			5.00
Heptachlorobiphenyl	3		0%			15
Hexachlorobiphenyl	3	2	67%	43	52	35
Monochlorobiphenyl	3		0%			5.00
Nonachlorobiphenyl	3		0%			25
Octachlorobiphenyl	3		0%			15
Pentachlorobiphenyl	3	2	67%	33	52	32
Tetrachlorobiphenyl	3		0%			10
Trichlorobiphenyl	3		0%			5.00
Total PCBs	3	2	67%	76	102	63
Pesticides, ug/kg						
4,4'-DDD	3		0%			8.67
4,4'-DDE	3	3	100%	3.4	29	18
4,4'-DDT	3		0%			8.67
Total DDT	3	3	100%	3	29	18
Aldrin	3		0%			4.60
Alpha Chlordane	3	1	33%	12	12	7.47
alpha-BHC	3		0%			4.60
beta-BHC	3		0%			4.60
delta-BHC	3		0%			4.60
Dieldrin	3		0%			8.67
Endosulfan I	3		0%			4.60
Endosulfan II	3		0%			8.67
Endosulfan sulfate	3		0%			8.67
Endrin	3		0%			8.67
Endrin aldehyde	3		0%			8.67
Endrin ketone	3		0%			8.67
Gamma Chlordane	3	1	33%	11	11	7.13
gamma-BHC (Lindane)	3		0%			4.60
Heptachlor	3	1	33%	2.8	2.8	3.20
Heptachlor epoxide	3		0%			4.60
Methoxychlor	3		0%			46
Toxaphene	3		0%			347
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	3		0%			85
1,2-Dichlorobenzene	3		0%			85
1,3-Dichlorobenzene	3		0%			85
1,4-Dichlorobenzene	3		0%			85
2,2'-Oxybis(1-chloropropane)(bis(2-Chlor	3		0%			85
2,4,5-Trichlorophenol	3		0%			210
2,4,6-Trichlorophenol	3		0%			85
2,4-Dichlorophenol	3		0%			85
2,4-Dimethylphenol	3		0%			85
2,4-Dinitrophenol	3		0%			210
2,4-Dinitrotoluene	3		0%			85
2,6-Dinitrotoluene	3		0%			85
2-Chloronaphthalene	3		0%			85
2-Chlorophenol	3		0%			85
2-Methyl-4,6-dinitrophenol	3		0%			210
2-Methylnaphthalene	3		0%			85
2-Methylphenol (o-cresol)	3		0%			85
2-Nitroaniline	3		0%			210
2-Nitrophenol	3		0%			85
3&4-Methylphenol (m&p-cresol)	3		0%			85
3,3'-Dichlorobenzidine	3		0%			85

Brown Bullhead Data Summary for Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
3-Nitroaniline	3		0%			210
4-Bromophenylphenyl ether	3		0%			85
4-Chloro-3-methylphenol	3		0%			85
4-Chloroaniline	3		0%			85
4-Chlorophenylphenyl ether	3		0%			85
4-Nitroaniline	3		0%			210
4-Nitrophenol	3		0%			210
Acenaphthene	3		0%			85
Acenaphthylene	3		0%			85
Anthracene	3		0%			85
Benzo(a)anthracene	3		0%			85
Benzo(a)pyrene	3		0%			85
Benzo(b)fluoranthene	3		0%			85
Benzo(g,h,i)perylene	3		0%			85
Benzo(k)fluoranthene	3		0%			85
bis(2-Chloroethoxy)methane	3		0%			85
bis(2-Chloroethyl)ether	3		0%			85
bis(2-Ethylhexyl)phthalate	3	1	33%	97	97	89
Butylbenzylphthalate	3		0%			85
Carbazole	3		0%			85
Chrysene	3		0%			85
Di-n-butylphthalate	3		0%			85
Di-n-octylphthalate	3		0%			85
Dibenzo(a,h)anthracene	3		0%			85
Dibenzofuran	3		0%			85
Diethylphthalate	3	1	33%	18	18	63
Dimethylphthalate	3		0%			85
Fluoranthene	3		0%			85
Fluorene	3		0%			85
Hexachlorobenzene	3		0%			85
Hexachlorobutadiene	3		0%			85
Hexachlorocyclopentadiene	3		0%			85
Hexachloroethane	3		0%			85
Indeno(1,2,3-cd)pyrene	3		0%			85
Isophorone	3		0%			85
n-Nitrosodi-n-propylamine	3		0%			85
N-Nitrosodiphenylamine/Diphenylamine	3		0%			85
Naphthalene	3		0%			85
Nitrobenzene	3		0%			127
Pentachlorophenol	3		0%			168
Phenanthrene	3		0%			85
Phenol	3		0%			85
Pyrene	2		0%			85
Total PAHs	3		0%			85
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	0.0102	0.01145	0.0109
1,2,3,4,6,7,8,9-OCDF	3	3	100%	0.000655	0.0012	0.000872
1,2,3,4,6,7,8-HpCDD	3	3	100%	0.0015	0.003	0.0022
1,2,3,4,6,7,8-HpCDF	3	1	33%	0.000545	0.000545	0.000382
1,2,3,4,7,8,9-HpCDF	3		0%			0.000308
1,2,3,4,7,8-HxCDD	3	1	33%	0.00018	0.00018	0.00026
1,2,3,4,7,8-HxCDF	3	3	100%	0.00059	0.0014	0.00099
1,2,3,6,7,8-HxCDD	3	3	100%	0.00078	0.0024	0.00153
1,2,3,6,7,8-HxCDF	3	1	33%	0.000245	0.000245	0.000232
1,2,3,7,8,9-HxCDD	3		0%			0.00025
1,2,3,7,8,9-HxCDF	3	1	33%	0.00069	0.00069	0.00041
1,2,3,7,8-PeCDD	3	3	100%	0.00042	0.0011	0.00080
1,2,3,7,8-PeCDF	3		0%			0.00016
2,3,4,6,7,8-HxCDF	3	2	67%	0.00016	0.00032	0.00029
2,3,4,7,8-PeCDF	3	3	100%	0.00077	0.0016	0.0013
2,3,7,8-TCDD	3	2	67%	0.00033	0.000835	0.000555
2,3,7,8-TCDF	3	3	100%	0.0012	0.004	0.0028
2,3,7,8-TCDF	3	3	100%	0.0016	0.0041	0.0030
Total HpCDD	3	3	100%	0.002	0.003	0.002516667
Total HpCDF	3	3	100%	0.0018	0.0051	0.003916667
Total HxCDD	3	3	100%	0.00078	0.0024	0.001576667
Total HxCDF	3	3	100%	0.0106	0.038	0.024433333
Total PeCDD	3	3	100%	0.00042	0.00118	0.0009
Total PeCDF	3	3	100%	0.0187	0.0491	0.036616667
Total TCDD	3	2	67%	0.00033	0.0012	0.000676667
Total TCDF	3	3	100%	0.022	0.053	0.040666667

Appendix C-3

Reference Area Brown Bullhead Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	3		0%			6.67
2,4,5-TP (Silvex)	3		0%			6.67
2,4-D	3		0%			6.67
2,4-DB	3		0%			6.67
Dalapon	3		0%			1333
Dicamba	3		0%			13
Dichloroprop	3		0%			67
Dinoseb	3		0%			67
MCPA[(4-chloro-2-methylphenoxy)-acetic a	3	1	33%	8600	8600	3533
MCPP[2-(4-chloro-2-methylphenoxy)-propan	3		0%			1333
Pentachlorophenol	3		0%			13
Metals, mg/kg						
Aluminum	3	3	100%	5.9	66	34
Antimony	3		0%			0.09
Arsenic	3		0%			1.20
Beryllium	3		0%			0.46
Cadmium	3		0%			0.23
Chromium	3	3	100%	0.34	0.48	0.41
Copper	3	3	100%	1.00	1.10	1.07
Cyanide, Total	3		0%			5.00
Lead	3	2	67%	0.18	0.23	0.21
Mercury	3	3	100%	0.05	0.10	0.08
Nickel	3		0%			4.55
Selenium	3	2	67%	0.48	0.50	0.40
Silver	3		0%			0.05
Zinc	3	3	100%	16	24	20
% Lipids	3	3	100%	1.00	1.40	1.13
PCB, ug/kg						
Decachlorobiphenyl	3		0%			25
Dichlorobiphenyl	3		0%			5.00
Heptachlorobiphenyl	3		0%			15
Hexachlorobiphenyl	3		0%			10
Monochlorobiphenyl	3		0%			5.00
Nonachlorobiphenyl	3		0%			25
Octachlorobiphenyl	3		0%			15
Pentachlorobiphenyl	3		0%			10
Tetrachlorobiphenyl	3		0%			10
Trichlorobiphenyl	3		0%			5.00
Total PCBs	3		0%			20
Pesticides, ug/kg						
4,4'-DDD	3	2	67%	1.2	2	5.33
4,4'-DDE	3	3	100%	4.7	12	8.83
4,4'-DDT	3		0%			8.67
Aldrin	3		0%			4.60
Alpha Chlordane	3	3	100%	1.1	2.5	1.57
alpha-BHC	3		0%			4.60
beta-BHC	3		0%			4.60
delta-BHC	3		0%			4.60
Dieldrin	3	3	100%	1.7	3.8	2.77
Endosulfan I	3		0%			4.60
Endosulfan II	3		0%			6.67
Endosulfan sulfate	3		0%			8.67
Endrin	3	1	33%	2.6	2.6	7.37
Endrin aldehyde	3		0%			8.67
Endrin ketone	3		0%			7.63
Gamma Chlordane	3	2	67%	6.1	6.2	6.43
gamma-BHC (Lindane)	3	2	67%	0.94	1.2	3.05
Heptachlor	3		0%			4.60
Heptachlor epoxide	3		0%			4.60
Methoxychlor	3		0%			46
Toxaphene	3		0%			347
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	3		0%			85
1,2-Dichlorobenzene	3		0%			85
1,3-Dichlorobenzene	3		0%			85
1,4-Dichlorobenzene	3		0%			85
2,2'-Oxybis(1-chloropropane)[bis(2-Chlor	3		0%			85
2,4,5-Trichlorophenol	3		0%			210
2,4,6-Trichlorophenol	3		0%			85
2,4-Dichlorophenol	3		0%			85
2,4-Dimethylphenol	3		0%			85
2,4-Dinitrophenol	3		0%			210
2,4-Dinitrotoluene	3		0%			85
2,6-Dinitrotoluene	3		0%			85
2-Chloronaphthalene	3		0%			85
2-Chlorophenol	3		0%			85
2-Methyl-4,6-dinitrophenol	3		0%			210
2-Methylnaphthalene	3		0%			85
2-Methylphenol (o-cresol)	3		0%			85
2-Nitroaniline	3		0%			210
2-Nitrophenol	3		0%			85
3&4-Methylphenol (m&p-cresol)	3		0%			85
3,3'-Dichlorobenzidine	3		0%			85
3-Nitroaniline	3		0%			210

Appendix C-3

Reference Area Brown Bullhead Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
4-Bromophenylphenyl ether	3		0%			85
4-Chloro-3-methylphenol	3		0%			85
4-Chloroaniline	3		0%			85
4-Chlorophenylphenyl ether	3		0%			85
4-Nitroaniline	3		0%			210
4-Nitrophenol	3		0%			210
Acenaphthene	3		0%			85
Acenaphthylene	3		0%			85
Anthracene	3		0%			85
Benzo(a)anthracene	3		0%			85
Benzo(a)pyrene	3		0%			85
Benzo(b)fluoranthene	3		0%			85
Benzo(g,h,i)perylene	3		0%			85
Benzo(k)fluoranthene	3		0%			85
bis(2-Chloroethoxy)methane	3		0%			85
bis(2-Chloroethyl)ether	3		0%			85
bis(2-Ethylhexyl)phthalate	3	2	67%	46	47	59
Butylbenzylphthalate	3		0%			85
Carbazole	3		0%			85
Chrysene	3		0%			85
Di-n-butylphthalate	3		0%			85
Di-n-octylphthalate	3		0%			85
Dibenzo(a,h)anthracene	3		0%			85
Dibenzofuran	3		0%			85
Diethylphthalate	3	1	33%	25	25	65
Dimethylphthalate	3		0%			85
Fluoranthene	3		0%			85
Fluorene	3		0%			85
Hexachlorobenzene	3		0%			85
Hexachlorobutadiene	3		0%			85
Hexachlorocyclopentadiene	3		0%			85
Hexachloroethane	3		0%			85
Indeno(1,2,3-cd)pyrene	3		0%			85
Isophorone	3		0%			85
n-Nitrosodi-n-propylamine	3		0%			85
N-Nitrosodiphenylamine/Diphenylamine	3		0%			85
Naphthalene	3		0%			85
Nitrobenzene	3		0%			127
Pentachlorophenol	3		0%			168
Phenanthrene	3		0%			85
Phenol	3		0%			85
Pyrene	2		0%			85
Total PAHs						
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	0.00270	0.0208	0.0147
1,2,3,4,6,7,8,9-OCDF	3	2	67%	0.000520	0.00160	0.000840
1,2,3,4,6,7,8-HpCDD	3	3	100%	0.000810	0.00300	0.00187
1,2,3,4,6,7,8-HpCDF	3		0%			0.000167
1,2,3,4,7,8,9-HpCDF	3		0%			0.000200
1,2,3,4,7,8-HxCDD	3		0%			0.000167
1,2,3,4,7,8-HxCDF	3	3	100%	0.000260	0.000490	0.000410
1,2,3,6,7,8-HxCDD	3	3	100%	0.000390	0.00120	0.000737
1,2,3,6,7,8-HxCDF	3		0%			0.000117
1,2,3,7,8,9-HxCDD	3		0%			0.000167
1,2,3,7,8,9-HxCDF	3		0%			0.000133
1,2,3,7,8-PeCDD	3		0%			0.000183
1,2,3,7,8-PeCDF	3		0%			0.000117
2,3,4,6,7,8-HxCDF	3		0%			0.000117
2,3,4,7,8-PeCDF	3	1	33%	0.000330	0.000330	0.000177
2,3,7,8-TCDD	3	2	67%	0.000200	0.000420	0.000290
2,3,7,8-TCDF	3	1	33%	0.000750	0.000750	0.000317
Total HpCDD	3	3	100%	0.000810	0.003600	0.00034
Total HpCDF	3	2	67%	0.00130	0.00140	0.000933
Total HxCDD	3	3	100%	0.000390	0.00120	0.000737
Total HxCDF	3	3	100%	0.00330	0.00810	0.00633
Total PeCDD	3		0%			0.000183
Total PeCDF	3	3	100%	0.00970	0.01830	0.01443
Total TCDD	3	3	100%	0.000200	0.000930	0.000647
Total TCDF	3	3	100%	0.00850	0.02530	0.01620

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Borrow Pit Lake Forage Fish Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T (ug/kg)	3		0%			6.67
2,4,5-TP (Silvex)	3		0%			6.67
2,4-D	3		0%			6.67
2,4-DB	3	2	67%	6.5	10	8.83
Dalapon	3		0%			1333
Dicamba	3	1	33%	2.6	2.6	11
Dichloroprop	3	1	33%	6.7	6.7	52
Dinoseb	3		0%			67
MCPA[(4-chloro-2-methylphenoxy)-	3	2	67%	3100	3300	2800
MCPP[2-(4-chloro-2-methylphenoxy)-	3		0%			1333
Pentachlorophenol	3	2	67%	1	2.2	7.73
Metals, mg/kg						
Aluminum	3	3	100%	24	52	40
Antimony	3		0%			0.09
Arsenic	3		0%			1.33
Beryllium	3		0%			0.47
Cadmium	3		0%			0.23
Chromium	3	3	100%	0.26	0.32	0.29
Copper	3	3	100%	0.5	1.7	0.99
Cyanide, Total	3		0%			5.00
Lead	3	1	33%	0.59	0.59	0.36
Mercury	3	2	67%	0.052	0.6	0.23
Nickel	3		0%			4.70
Selenium	3	2	67%	0.53	0.54	0.44
Silver	3		0%			0.05
Zinc	3	3	100%	24	33	30
% Lipids	3	3	100%	1.5	1.8	1.63
PCB, ug/kg						
Decachlorobiphenyl	3		0%			42
Dichlorobiphenyl	3		0%			8.33
Heptachlorobiphenyl	3		0%			25
Hexachlorobiphenyl	3	2	67%	19	22	20
Monochlorobiphenyl	3		0%			8.33
Nonachlorobiphenyl	3		0%			42
Octachlorobiphenyl	3		0%			25
Pentachlorobiphenyl	3	1	33%	8.7	8.7	16
Tetrachlorobiphenyl	3		0%			17
Trichlorobiphenyl	3		0%			8.33
Total PCBs	3	2	67%	31	39	30
Pesticides, ug/kg						
4,4'-DDD	3		0%			8.8
4,4'-DDE	3	3	100%	4.1	10	7.73
4,4'-DDT	3		0%			8.83
Total DDT	3	3	100%	4.1	10	7.70
Aldrin	3		0%			4.47
Alpha Chlordane	3		0%			4.47
alpha-BHC	3		0%			4.47
beta-BHC	3		0%			4.47
delta-BHC	3		0%			4.47
Dieldrin	3		0%			8.83
Endosulfan I	3		0%			4.47
Endosulfan II	3		0%			8.83
Endosulfan sulfate	3		0%			8.83
Endrin	3		0%			8.83
Endrin aldehyde	3		0%			8.83
Endrin ketone	3		0%			8.83
Gamma Chlordane	3		0%			4.47
gamma-BHC (Lindane)	3		0%			4.47
Heptachlor	3		0%			4.47
Heptachlor epoxide	3		0%			4.47
Methoxychlor	3		0%			45
Toxaphene	3		0%			447
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	3		0%			142
1,2-Dichlorobenzene	3		0%			142
1,3-Dichlorobenzene	3		0%			142
1,4-Dichlorobenzene	3		0%			142
2,2'-Oxybis(1-chloropropane)(bis(2-	3		0%			142
2,4,5-Trichlorophenol	3		0%			350
2,4,6-Trichlorophenol	3		0%			142
2,4-Dichlorophenol	3		0%			142
2,4-Dimethylphenol	3		0%			142
2,4-Dinitrophenol	3		0%			350
2,4-Dinitrotoluene	3		0%			142
2,6-Dinitrotoluene	3		0%			142
2-Chloronaphthalene	3		0%			142
2-Chlorophenol	3		0%			142
2-Methyl-4,6-dinitrophenol	3		0%			350
2-Methylnaphthalene	3		0%			142
2-Methylphenol (o-cresol)	3		0%			142
2-Nitroaniline	3		0%			350
2-Nitrophenol	3		0%			142
3&4-Methylphenol (m&p-cresol)	3		0%			142
3,3'-Dichlorobenzidine	3		0%			142

Appendix C-3

Borrow Pit Lake Forage Fish Data Summary
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
3-Nitroaniline	3		0%			350
4-Bromophenylphenyl ether	3		0%			142
4-Chloro-3-methylphenol	3		0%			142
4-Chloroaniline	3		0%			142
4-Chlorophenylphenyl ether	3		0%			142
4-Nitroaniline	3		0%			350
4-Nitrophenol	3		0%			350
Acenaphthene	3		0%			142
Acenaphthylene	3		0%			142
Anthracene	3		0%			142
Benzo(a)anthracene	3		0%			142
Benzo(a)pyrene	3		0%			142
Benzo(b)fluoranthene	3		0%			142
Benzo(g,h,i)perylene	3		0%			142
Benzo(k)fluoranthene	3		0%			142
bis(2-Chloroethoxy)methane	3		0%			142
bis(2-Chloroethyl)ether	3		0%			142
bis(2-Ethylhexyl)phthalate	3	2	67%	150	230	183
Butylbenzylphthalate	3		0%			142
Carbazole	3		0%			142
Chrysene	3		0%			142
Di-n-butylphthalate	3		0%			142
Di-n-octylphthalate	3		0%			142
Dibenzo(a,h)anthracene	3	1	33%	48	48	101
Dibenzofuran	3		0%			142
Diethylphthalate	3	3	100%	19	37	31
Dimethylphthalate	3		0%			142
Fluoranthene	3		0%			142
Fluorene	3		0%			142
Hexachlorobenzene	3		0%			142
Hexachlorobutadiene	3		0%			142
Hexachlorocyclopentadiene	3		0%			142
Hexachloroethane	3		0%			142
Indeno(1,2,3-cd)pyrene	3	1	33%	54	54	103
Isophorone	3		0%			142
n-Nitrosodi-n-propylamine	3		0%			142
N-Nitrosodiphenylamine/Diphenylamine	3		0%			142
Naphthalene	3		0%			142
Nitrobenzene	3		0%			142
Pentachlorophenol	3		0%			350
Phenanthrene	3		0%			142
Phenol	3		0%			142
Pyrene	3		0%			142
Total PAHs	3	1	33%	102	102	360
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	0.0089	0.0269	0.019866667
1,2,3,4,6,7,8,9-OCDF	3	2	67%	0.0013	0.0044	0.002083333
1,2,3,4,6,7,8-HpCDD	3	3	100%	0.0012	0.0018	0.001533333
1,2,3,4,6,7,8-HpCDF	3	1	33%	0.001	0.001	0.000483333
1,2,3,4,7,8,9-HpCDF	3	1	33%	0.00058	0.00058	0.000443333
1,2,3,4,7,8-HxCDD	3		0%			0.0002
1,2,3,4,7,8-HxCDF	3	2	67%	0.00041	0.00077	0.00046
1,2,3,6,7,8-HxCDD	3	1	33%	0.0006	0.0006	0.00035
1,2,3,6,7,8-HxCDF	3		0%			0.000116667
1,2,3,7,8,9-HxCDD	3		0%			0.000216667
1,2,3,7,8,9-HxCDF	3		0%			0.000183333
1,2,3,7,8-PeCDD	3		0%			0.000216667
1,2,3,7,8-PeCDF	3		0%			0.000133333
2,3,4,6,7,8-HxCDF	3		0%			0.000133333
2,3,4,7,8-PeCDF	3	1	33%	0.00046	0.00046	0.00027
2,3,7,8-TCDD	3	1	33%	0.00072	0.00072	0.00039
2,3,7,8-TCDF	3	3	100%	0.004	0.00725	0.005216667
Total HpCDD	3	3	100%	0.0012	0.0028	0.0022
Total HpCDF	3	3	100%	0.0018	0.0067	0.0035
Total HxCDD	3	1	33%	0.0006	0.0006	0.000366667
Total HxCDF	3	3	100%	0.0072	0.0136	0.009366667
Total PeCDD	3		0%			0.000216667
Total PeCDF	3	3	100%	0.0085	0.0189	0.012666667
Total TCDD	3	1	33%	0.00072	0.00072	0.00039
Total TCDF	3	3	100%	0.0141	0.025	0.017833333

Reference Area Forage Fish
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	4		0%			5.00
2,4,5-TP (Silvex)	4		0%			5.00
2,4-D	4		0%			5.00
2,4-DB	4	1	25%	10	10	6.25
Dalapon	4		0%			1000
Dicamba	4		0%			10
Dichloroprop	4	1	25%	5.1	5.1	39
Dinoseb	4		0%			50
MCPA[(4-chloro-2-methylphenoxy)-acetic a	4	1	25%	2400	2400	1350
MCPP[2-(4-chloro-2-methylphenoxy)-propan	4		0%			1000
Pentachlorophenol	4	2	50%	1.5	2.2	4.28
Metals, mg/kg						
Aluminum	4	4	100%	8.3	100	50
Antimony	4		0%			0.09
Arsenic	4		0%			1.35
Beryllium	4		0%			0.47
Cadmium	4		0%			0.23
Chromium	4	4	100%	0.24	1.7	0.71
Copper	4	4	100%	0.42	0.75	0.54
Cyanide, Total	4		0%			5.00
Lead	4	1	25%	0.37	0.37	0.27
Mercury	4	4	100%	0.046	0.064	0.05
Nickel	4		0%			4.66
Selenium	4	2	50%	0.56	0.65	0.42
Silver	4		0%			0.05
Zinc	4	4	100%	17	33	26
% Lipids	4	4	100%	1	2.6	1.60
PCB, ug/kg						
Decachlorobiphenyl	4		0%			44
Dichlorobiphenyl	4		0%			8.75
Heptachlorobiphenyl	4		0%			26
Hexachlorobiphenyl	4		0%			18
Monochlorobiphenyl	4		0%			8.75
Nonachlorobiphenyl	4		0%			44
Octachlorobiphenyl	4		0%			26
Pentachlorobiphenyl	4		0%			18
Tetrachlorobiphenyl	4		0%			18
Trichlorobiphenyl	4		0%			8.75
Total PCBs						
Pesticides, ug/kg						
4,4'-DDD	3		0%			8.83
4,4'-DDE	3	2	67%	1.3	3.5	4.93
4,4'-DDT	3		0%			8.83
Aldrin	3		0%			4.47
Alpha Chlordane	3		0%			4.47
alpha-BHC	3		0%			4.47
beta-BHC	3		0%			4.47
delta-BHC	3		0%			4.47
Dieldrin	3	2	67%	1.6	4.7	5.43
Endosulfan I	3		0%			4.47
Endosulfan II	3		0%			8.83
Endosulfan sulfate	3		0%			8.83
Endrin	3		0%			8.83
Endrin aldehyde	3		0%			8.83
Endrin ketone	3		0%			8.83
Gamma Chlordane	3	1	33%	1.2	1.2	3.20
gamma-BHC (Lindane)	3		0%			4.47
Heptachlor	3		0%			4.47
Heptachlor epoxide	3		0%			4.47
Methoxychlor	3		0%			45
Toxaphene	3		0%			447
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	4		0%			106
1,2-Dichlorobenzene	4		0%			106
1,3-Dichlorobenzene	4		0%			106
1,4-Dichlorobenzene	4		0%			106
2,2'-Oxybis(1-chloropropane)[bis(2-Chlor	4		0%			106
2,4,5-Trichlorophenol	4		0%			263
2,4,6-Trichlorophenol	4		0%			106
2,4-Dichlorophenol	4		0%			106
2,4-Dimethylphenol	4		0%			106
2,4-Dinitrophenol	4		0%			263
2,4-Dinitrotoluene	4		0%			106
2,6-Dinitrotoluene	4		0%			106
2-Chloronaphthalene	4		0%			106
2-Chlorophenol	4		0%			106
2-Methyl-4,6-dinitrophenol	4		0%			263
2-Methylnaphthalene	4		0%			106
2-Methylphenol (o-cresol)	4		0%			106
2-Nitroaniline	4		0%			263
2-Nitrophenol	4		0%			106
3&4-Methylphenol (m&p-cresol)	4		0%			106
3,3'-Dichlorobenzidine	4		0%			106
3-Nitroaniline	4		0%			263

Appendix C-3

Reference Area Forage Fish
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
4-Bromophenylphenyl ether	4		0%			106
4-Chloro-3-methylphenol	4		0%			106
4-Chloroaniline	4		0%			106
4-Chlorophenylphenyl ether	4		0%			106
4-Nitroaniline	4		0%			263
4-Nitrophenol	4		0%			263
Acenaphthene	4		0%			106
Acenaphthylene	4		0%			106
Anthracene	4		0%			106
Benzo(a)anthracene	4		0%			106
Benzo(a)pyrene	4		0%			106
Benzo(b)fluoranthene	4		0%			106
Benzo(g,h,i)perylene	4		0%			106
Benzo(k)fluoranthene	4		0%			106
bis(2-Chloroethoxy)methane	4		0%			106
bis(2-Chloroethyl)ether	4		0%			106
bis(2-Ethylhexyl)phthalate	4	4	100%	99	280	172
Butylbenzylphthalate	4		0%			106
Carbazole	3		0%			113
Chrysene	4		0%			106
Di-n-butylphthalate	4		0%			106
Di-n-octylphthalate	4		0%			106
Dibenzo(a,h)anthracene	4		0%			106
Dibenzofuran	4		0%			106
Diethylphthalate	4	3	75%	18	37	61
Dimethylphthalate	4		0%			106
Fluoranthene	4		0%			106
Fluorene	4		0%			106
Hexachlorobenzene	4		0%			106
Hexachlorobutadiene	4		0%			106
Hexachlorocyclopentadiene	4		0%			106
Hexachloroethane	4		0%			106
Indeno(1,2,3-cd)pyrene	4		0%			106
Isophorone	4		0%			106
n-Nitrosodi-n-propylamine	4		0%			106
N-Nitrosodiphenylamine/Diphenylamine	4		0%			106
Naphthalene	4		0%			106
Nitrobenzene	4		0%			106
Pentachlorophenol	4		0%			263
Phenanthrene	4		0%			106
Phenol	4		0%			106
Pyrene	4		0%			106
Total PAHs						
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	4	4	100%	0.0223	0.068	0.04155
1,2,3,4,6,7,8,9-OCDF	4	3	75%	0.0014	0.018	0.005325
1,2,3,4,6,7,8-HpCDD	4	4	100%	0.0018	0.0047	0.00325
1,2,3,4,6,7,8-HpCDF	4	1	25%	0.0016	0.0016	0.0005125
1,2,3,4,7,8,9-HpCDF	4		0%			0.000275
1,2,3,4,7,8-HxCDD	4		0%			0.0002
1,2,3,4,7,8-HxCDF	4	3	75%	0.00023	0.00057	0.0003375
1,2,3,6,7,8-HxCDD	4	4	100%	0.00044	0.00067	0.0005875
1,2,3,6,7,8-HxCDF	4		0%			0.000125
1,2,3,7,8,9-HxCDD	4		0%			0.0002125
1,2,3,7,8,9-HxCDF	4		0%			0.0001625
1,2,3,7,8-PeCDD	4	1	25%	0.00095	0.00095	0.000375
1,2,3,7,8-PeCDF	4		0%			0.00015
2,3,4,6,7,8-HxCDF	4		0%			0.0001375
2,3,4,7,8-PeCDF	4		0%			0.0001625
2,3,7,8-TCDD	4	3	75%	0.00046	0.00086	0.0005125
2,3,7,8-TCDF	4	3	75%	0.00095	0.0029	0.000301
Total HpCDD	4	4	100%	0.0023	0.0074	0.0049
Total HpCDF	4	2	50%	0.0015	0.0067	0.002175
Total HxCDD	4	4	100%	0.00058	0.0016	0.0008775
Total HxCDF	4	4	100%	0.0017	0.0073	0.003775
Total PeCDD	4	1	25%	0.00095	0.00095	0.000375
Total PeCDF	4	4	100%	0.0062	0.012	0.009325
Total TCDD	4	3	75%	0.00048	0.0012	0.0007
Total TCDF	4	4	100%	0.0107	0.0182	0.013425

Appendix C-3

Combined Summary Statistics for Largemouth Bass and Brown Bullhead
Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T (ug/kg)	6		0%			5.00
2,4,5-TP (Silvex)	6		0%			5.00
2,4-D	6		0%			5.00
2,4-DB	6		0%			5.00
Dalapon	6		0%			1000
Dicamba	6	1	17%	1.90	1.90	6.98
Dichloroprop	6	1	17%	6.60	6.60	43
Dinoseb	6		0%			50
MCPA[(4-chloro-2-methylphenoxy)-	6	1	17%	1,800.00	1,800.00	1133
MCPP[2-(4-chloro-2-methylphenoxy)-	6		0%			1000
Pentachlorophenol	6		0%			8.33
Metals, mg/kg						
Aluminum	6	5	83%	7.70	33.00	16
Antimony	6		0%			0.09
Arsenic	6		0%			2.30
Beryllium	6		0%			0.47
Cadmium	6		0%			0.23
Chromium	6	6	100%	0.27	0.93	0.53
Copper	6	6	100%	0.41	0.89	0.69
Cyanide, Total	6		0%			5.00
Lead	6	1	17%	0.25	0.25	0.24
Mercury	6	5	83%	0.05	0.26	0.09
Nickel	6		0%			4.70
Selenium	6	2	33%	0.60	0.63	0.36
Silver	6		0%			0.05
Zinc	6	6	100%	15.00	22.00	18
% Lipid	6	6	100%	0.30	1.80	1.37
PCB, ug/kg						
Decachlorobiphenyl	6		0%			25
Dichlorobiphenyl	6		0%			5.00
Heptachlorobiphenyl	6	2	33%	16.00	21.00	16
Hexachlorobiphenyl	6	5	83%	43.00	150.00	70
Monochlorobiphenyl	6		0%			5.00
Nonachlorobiphenyl	6		0%			25
Octachlorobiphenyl	6		0%			15
Pentachlorobiphenyl	6	5	83%	30.00	130.00	61
Tetrachlorobiphenyl	6	2	33%	19.00	46.00	18
Trichlorobiphenyl	6		0%			5.00
Total PCBs	6	5	83%	76.00	320.00	150
Pesticides, ug/kg						
4,4'-DDD	6		0%			7.58
4,4'-DDE	6	5	83%	3.40	29.00	16
4,4'-DDT	6		0%			7.58
Total DDT	6	5	83%	3.40	29.00	16
Aldrin	6		0%			4.00
Alpha Chlordane	6	1	17%	12.00	12.00	5.43
alpha-BHC	6		0%			4.00
beta-BHC	6		0%			4.00
delta-BHC	6		0%			4.00
Dieldrin	6		0%			7.58
Endosulfan I	6		0%			4.00
Endosulfan II	6		0%			7.58
Endosulfan sulfate	6		0%			7.58
Endrin	6		0%			7.58
Endrin aldehyde	6		0%			7.58
Endrin ketone	6		0%			7.58
Gamma Chlordane	6	3	50%	11.00	19.00	9.80
gamma-BHC (Lindane)	6		0%			4.00
Heptachlor	6	2	33%	1.50	2.80	2.98
Heptachlor epoxide	6		0%			4.00
Methoxychlor	6		0%			40
Toxaphene	6		0%			343
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	6		0%			85
1,2-Dichlorobenzene	6		0%			85
1,3-Dichlorobenzene	6		0%			85
1,4-Dichlorobenzene	6		0%			85
2,2'-Oxybis(1-chloropropane)(bis(2-	6		0%			85
2,4,5-Trichlorophenol	6		0%			210
2,4,6-Trichlorophenol	6		0%			85
2,4-Dichlorophenol	6		0%			85
2,4-Dimethylphenol	6		0%			85
2,4-Dinitrophenol	6		0%			210
2,4-Dinitrotoluene	6		0%			85
2,6-Dinitrotoluene	6		0%			85
2-Chloronaphthalene	6		0%			85
2-Chlorophenol	6		0%			85
2-Methyl-4,6-dinitrophenol	6		0%			210
2-Methylnaphthalene	6		0%			85
2-Methylphenol (o-cresol)	6		0%			85
2-Nitroaniline	6		0%			210
2-Nitrophenol	6		0%			85
3&4-Methylphenol (m&p-cresol)	6		0%			85

Appendix C-3

Combined Summary Statistics for Largemouth Bass and Brown Bullhead
Borrow Pit Lake
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
3,3'-Dichlorobenzidine	6		0%			85
3-Nitroaniline	6		0%			210
4-Bromophenylphenyl ether	6		0%			85
4-Chloro-3-methylphenol	6		0%			85
4-Chloroaniline	6		0%			85
4-Chlorophenylphenyl ether	6		0%			85
4-Nitroaniline	6		0%			210
4-Nitrophenol	6		0%			210
Acenaphthene	6		0%			85
Acenaphthylene	6		0%			85
Anthracene	6		0%			85
Benzo(a)anthracene	6		0%			85
Benzo(a)pyrene	6		0%			85
Benzo(b)fluoranthene	6		0%			85
Benzo(g,h,i)perylene	6		0%			85
Benzo(k)fluoranthene	6		0%			85
bis(2-Chloroethoxy)methane	6		0%			85
bis(2-Chloroethyl)ether	6		0%			85
bis(2-Ethylhexyl)phthalate	6	1	17%	97.00	97.00	90
Butylbenzylphthalate	6		0%			85
Carbazole	6		0%			85
Chrysene	6		0%			85
Di-n-butylphthalate	6	1	17%	32.00	32.00	76
Di-n-octylphthalate	6		0%			85
Dibenzo(a,h)anthracene	6		0%			85
Dibenzofuran	6		0%			85
Diethylphthalate	6	1	17%	18.00	18.00	74
Dimethylphthalate	6		0%			85
Fluoranthene	6		0%			85
Fluorene	6		0%			85
Hexachlorobenzene	6		0%			85
Hexachlorobutadiene	6		0%			85
Hexachlorocyclopentadiene	6		0%			85
Hexachloroethane	6		0%			85
Indeno(1,2,3-cd)pyrene	6		0%			85
Isophorone	6		0%			85
n-Nitrosodi-n-propylamine	6		0%			85
N-Nitrosodiphenylamine/Diphenylamine	6		0%			85
Naphthalene	6		0%			85
Nitrobenzene	6		0%			106
Pentachlorophenol	6		0%			189
Phenanthrene	6		0%			85
Phenol	6		0%			85
Pyrene	5		0%			85
Total PAHs	6		0%			85
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	6	3	50%	0.0102	0.01145	0.008708333
1,2,3,4,6,7,8,9-OCDF	6	3	50%	0.000655	0.0012	0.000960833
1,2,3,4,6,7,8-HpCDD	6	3	50%	0.0015	0.003	0.00155
1,2,3,4,6,7,8-HpCDF	6	1	17%	0.000545	0.000545	0.000240833
1,2,3,4,7,8,9-HpCDF	6		0%			0.0002375
1,2,3,4,7,8-HxCDD	6	1	17%	0.00018	0.00018	0.000205
1,2,3,4,7,8-HxCDF	6	4	67%	0.00048	0.0014	0.000614167
1,2,3,6,7,8-HxCDD	6	4	67%	0.00054	0.0024	0.00091
1,2,3,6,7,8-HxCDF	6	2	33%	0.00023	0.000245	0.0001875
1,2,3,7,8,9-HxCDD	6		0%			0.000191667
1,2,3,7,8,9-HxCDF	6	1	17%	0.00069	0.00069	0.000256667
1,2,3,7,8-PeCDD	6	4	67%	0.00042	0.0011	0.000649167
1,2,3,7,8-PeCDF	6	1	17%	0.0011	0.0011	0.0002775
2,3,4,6,7,8-HxCDF	6	3	50%	0.00016	0.00038	0.000251667
2,3,4,7,8-PeCDF	6	5	83%	0.00071	0.0016	0.000985
2,3,7,8-TCDD	6	4	67%	0.00033	0.0009	0.000644167
2,3,7,8-TCDF	6	6	100%	0.0012	0.0114	0.006045833
Total HpCDD	6	5	83%	0.0014	0.003	0.001975
Total HpCDF	6	4	67%	0.0018	0.0067	0.004141667
Total HxCDD	6	4	67%	0.00054	0.0024	0.001028333
Total HxCDF	6	3	50%	0.0106	0.038	0.020591667
Total PeCDD	6	4	67%	0.00042	0.00118	0.000700833
Total PeCDF	6	3	50%	0.0187	0.0491	0.02785
Total TCDD	6	3	50%	0.00033	0.0012	0.00063
Total TCDF	6	3	50%	0.022	0.053	0.035558333

Appendix C-3

Creek Sector F Plant Tissue Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T (ug/kg)	2		0%			5.00
2,4,5-TP (Silvex)	2		0%			5.00
2,4-D	2		0%			5.00
2,4-DB	2		0%			5.00
Dalapon	2		0%			1000
Dicamba	2		0%			10
Dichloroprop	2	1	50%	7	7	29
Dinoseb	2		0%			50
MCPA[(4-chloro-2-methylphenoxy)-	2		0%			1000
MCPP[2-(4-chloro-2-methylphenoxy)-	2		0%			1000
Pentachlorophenol	2		0%			10
Metals, mg/kg						
Aluminum	2	2	100%	30	44	37
Antimony	2	1	50%	0.13	0.13	0.12
Arsenic	2	2	100%	0.42	0.56	0.49
Beryllium	2		0%			0.50
Cadmium	2	1	50%	0.097	0.097	0.17
Chromium	2		0%			0.25
Copper	2	2	100%	1.9	2.1	2.00
Cyanide, Total	2		0%			5.00
Lead	2	2	100%	0.44	1.2	0.82
Mercury	2		0%			0.01
Nickel	2	2	100%	1.2	2.6	1.90
Selenium	2		0%			0.25
Silver	2		0%			0.04
Zinc	2	2	100%	20	26	23
PCBs and Pesticides, ug/kg						
Decachlorobiphenyl	2		0%			25
Dichlorobiphenyl	2		0%			5.00
Heptachlorobiphenyl	2		0%			15
Hexachlorobiphenyl	2		0%			10
Monochlorobiphenyl	2		0%			5.00
Nonachlorobiphenyl	2		0%			25
Octachlorobiphenyl	2		0%			15
Pentachlorobiphenyl	2		0%			10
Tetrachlorobiphenyl	2		0%			10
Trichlorobiphenyl	2		0%			5.00
Total PCBs	2		0%			5.00
4,4'-DDD (ug/kg)	2		0%			13
4,4'-DDE	2		0%			13
4,4'-DDT	2		0%			13
Total DDT	2		0%			13
Aldrin	2	1	50%	0.81	0.81	3.91
Alpha Chlordane	2		0%			7.00
alpha-BHC	2		0%			7.00
beta-BHC	2		0%			7.00
delta-BHC	2		0%			7.00
Dieldrin	2		0%			13
Endosulfan I	2		0%			7.00
Endosulfan II	2		0%			13
Endosulfan sulfate	2		0%			13
Endrin	2		0%			13
Endrin aldehyde	2		0%			13
Endrin ketone	2		0%			13
Gamma Chlordane	2	1	50%	3.1	3.1	5.05
gamma-BHC (Lindane)	2		0%			7.00
Heptachlor	2	2	100%	1.8	1.9	1.85
Heptachlor epoxide	2		0%			7.00
Methoxychlor	2		0%			70
Toxaphene	2		0%			360
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	2		0%			85
1,2-Dichlorobenzene	2		0%			85
1,3-Dichlorobenzene	2		0%			85
1,4-Dichlorobenzene	2		0%			85
2,2'-Oxybis(1-chloropropane)[bis(2-	2		0%			85
2,4,5-Trichlorophenol	2		0%			210
2,4,6-Trichlorophenol	2		0%			85
2,4-Dichlorophenol (ug/kg)	2		0%			85
2,4-Dimethylphenol	2	1	50%	51	51	68
2,4-Dinitrophenol	2		0%			210
2,4-Dinitrotoluene	2		0%			85
2,6-Dinitrotoluene	2		0%			85
2-Chloronaphthalene	2		0%			85
2-Chlorophenol	2		0%			85
2-Methyl-4,6-dinitrophenol	2		0%			210
2-Methylnaphthalene	2		0%			85
2-Methylphenol (o-cresol)	2		0%			85
2-Nitroaniline	2		0%			210
2-Nitrophenol	2		0%			85
3&4-Methylphenol (m&p-cresol)	2		0%			85
3,3'-Dichlorobenzidine	2		0%			85
3-Nitroaniline	2		0%			210
4-Bromophenylphenyl ether	2		0%			85
4-Chloro-3-methylphenol	2		0%			85

Appendix C-3

Creek Sector F Plant Tissue Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
4-Chloroaniline	2		0%			85
4-Chlorophenylphenyl ether	2		0%			85
4-Nitroaniline	2		0%			210
4-Nitrophenol	2		0%			210
Acenaphthene	2		0%			85
Acenaphthylene	2	1	50%	32	32	59
Anthracene	2		0%			85
Benzo(a)anthracene	2		0%			85
Benzo(a)pyrene	2	1	50%	140	140	113
Benzo(b)fluoranthene	2	1	50%	59	59	72
Benzo(g,h,i)perylene	2	1	50%	360	360	223
Benzo(k)fluoranthene	2	1	50%	52	52	69
bis(2-Chloroethoxy)methane	2		0%			85
bis(2-Chloroethyl)ether	2		0%			85
bis(2-Ethylhexyl)phthalate	2		0%			85
Butylbenzylphthalate	2		0%			85
Chrysene	2		0%			85
Di-n-butylphthalate	2		0%			85
Di-n-octylphthalate	2		0%			85
Dibenzo(a,h)anthracene	2	1	50%	76	76	81
Dibenzofuran	2		0%			85
Diethylphthalate	2		0%			85
Dimethylphthalate	2		0%			85
Fluoranthene	2		0%			85
Fluorene	2		0%			85
Hexachlorobenzene	2		0%			85
Hexachlorobutadiene	2		0%			85
Hexachlorocyclopentadiene	2		0%			85
Hexachloroethane	2		0%			85
Indeno(1,2,3-cd)pyrene	2	1	50%	300	300	193
Isophorone	2		0%			85
n-Nitrosodi-n-propylamine	2		0%			85
N-	2		0%			85
Naphthalene	2		0%			85
Nitrobenzene	2		0%			85
Pentachlorophenol	2		0%			210
Phenanthrene	2		0%			85
Phenol	2		0%			85
Pyrene	2		0%			85
Total PAHs	2	1	50%	660	660	460
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	2	2	100%	0.0569	0.0833	0.0701
1,2,3,4,6,7,8,9-OCDF	2	2	100%	0.0226	0.0335	0.02805
1,2,3,4,6,7,8-HpCDD	2	2	100%	0.0074	0.0116	0.0095
1,2,3,4,6,7,8-HpCDF	2	2	100%	0.0057	0.0074	0.00655
1,2,3,4,7,8,9-HpCDF	2		0%			0.0003
1,2,3,4,7,8-HxCDD	2		0%			0.00025
1,2,3,4,7,8-HxCDF	2		0%			0.0002
1,2,3,6,7,8-HxCDD	2		0%			0.00025
1,2,3,6,7,8-HxCDF	2		0%			0.00015
1,2,3,7,8,9-HxCDD	2		0%			0.00025
1,2,3,7,8,9-HxCDF	2		0%			0.0002
1,2,3,7,8-PeCDD	2		0%			0.0002
1,2,3,7,8-PeCDF	2		0%			0.000175
2,3,4,6,7,8-HxCDF	2		0%			0.000175
2,3,4,7,8-PeCDF	2		0%			0.000175
2,3,7,8-TCDD	2		0%			0.000225
2,3,7,8-TCDF	2		0%			0.0002
2,3,7,8-TCDF						
Total HpCDD	2	2	100%	0.014	0.0211	0.01755
Total HpCDF	2	2	100%	0.0173	0.0256	0.02145
Total HxCDD	2	2	100%	0.0025	0.0032	0.00285
Total HxCDF	2	2	100%	0.003	0.0064	0.0047
Total PeCDD	2		0%			0.0002
Total PeCDF	2		0%			0.000175
Total TCDD	2	2	100%	0.0028	0.0031	0.00295
Total TCDF	2	1	50%	0.0024	0.0024	0.0013

Appendix C-3

Summary Statistics for Reference Plant Tissue Data
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentraton
Herbicides, ug/kg						
2,4,5-T	2		0%			5.00
2,4,5-TP (Silvex)	2		0%			5.00
2,4-D	2		0%			5.00
2,4-DB	2		0%			5.00
Dalapon	2		0%			1000
Dicamba	2	1	50%	1.8	1.8	5.90
Dichloroprop	2		0%			50
Dinoseb	2		0%			50
MCPA[(4-chloro-2-methylphenoxy)-acetic a	2		0%			1000
MCPP[2-(4-chloro-2-methylphenoxy)-propan	2	1	50%	1300	1300	1150
Pentachlorophenol	2	1	50%	2	2	6.00
Metals, mg/kg						
Aluminum	2	2	100%	160	360	260
Antimony	2		0%			0.10
Arsenic	2	1	50%	1.1	1.1	0.78
Beryllium	2		0%			0.50
Cadmium	2		0%			0.25
Chromium	2	2	100%	0.25	0.53	0.39
Copper	2	2	100%	0.95	1.3	1.13
Cyanide, Total	2		0%			5.00
Lead	2	2	100%	0.3	0.64	0.47
Mercury	2		0%			0.01
Nickel	2		0%			5.00
Selenium	2		0%			0.25
Silver	2		0%			0.05
Zinc	2	2	100%	6.8	8.3	7.55
PCBs and Pesticides, ug/kg						
Decachlorobiphenyl	2		0%			25
Dichlorobiphenyl	2		0%			5.00
Heptachlorobiphenyl	2		0%			15
Hexachlorobiphenyl	2		0%			10
Monochlorobiphenyl	2		0%			5.00
Nonachlorobiphenyl	2		0%			25
Octachlorobiphenyl	2		0%			15
Pentachlorobiphenyl	2		0%			10
Tetrachlorobiphenyl	2		0%			10
Trichlorobiphenyl	2		0%			5.00
4,4'-DDD	2		0%			13
4,4'-DDE	2		0%			13
4,4'-DDT	2		0%			13
Aldrin	2	1	50%	1	1	4.00
Alpha Chlordane	2		0%			7.00
alpha-BHC	2		0%			7.00
beta-BHC	2		0%			7.00
delta-BHC	2		0%			7.00
Dieldrin	2		0%			13
Endosulfan I	2		0%			7.00
Endosulfan II	2		0%			13
Endosulfan sulfate	2		0%			13
Endrin	2		0%			13
Endrin aldehyde	2		0%			13
Endrin ketone	2		0%			13
Gamma Chlordane	2		0%			7.00
gamma-BHC (Lindane)	2		0%			7.00
Heptachlor	2	1	50%	3.8	3.8	5.40
Heptachlor epoxide	2		0%			7.00
Methoxychlor	2		0%			70
Toxaphene	2		0%			360
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	2		0%			85
1,2-Dichlorobenzene	2		0%			85
1,3-Dichlorobenzene	2		0%			85
1,4-Dichlorobenzene	2		0%			85
2,2'-Oxybis(1-chloropropane)(bis(2-Chlor	2		0%			85
2,4,5-Trichlorophenol	2		0%			210
2,4,6-Trichlorophenol	2		0%			85
2,4-Dichlorophenol	2		0%			85
2,4-Dimethylphenol	2		0%			85
2,4-Dinitrophenol	2		0%			210
2,4-Dinitrotoluene	2		0%			85
2,6-Dinitrotoluene	2		0%			85
2-Chloronaphthalene	2		0%			85
2-Chlorophenol	2		0%			85
2-Methyl-4,6-dinitrophenol	2		0%			210
2-Methylnaphthalene	2		0%			85
2-Methylphenol (o-cresol)	2		0%			85
2-Nitroaniline	2		0%			210
2-Nitrophenol	2		0%			85
3&4-Methylphenol (m&p-cresol)	2		0%			85
3,3'-Dichlorobenzidine	2		0%			85
3-Nitroaniline	2		0%			210
4-Bromophenylphenyl ether	2		0%			85
4-Chloro-3-methylphenol	2		0%			85
4-Chloroaniline	2		0%			85
4-Chlorophenylphenyl ether	2		0%			85

Appendix C-3

Summary Statistics for Reference Plant Tissue Data
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentraton
4-Nitroaniline	2		0%			210
4-Nitrophenol	2		0%			210
Acenaphthene	2		0%			85
Acenaphthylene	2		0%			85
Anthracene	2		0%			85
Benzo(a)anthracene	2		0%			85
Benzo(a)pyrene	2	2	100%	15	37	26
Benzo(b)fluoranthene	2	1	50%	16	16	51
Benzo(g,h,i)perylene	2	2	100%	240	390	315
Benzo(k)fluoranthene	2	1	50%	21	21	53
bis(2-Chloroethoxy)methane	2		0%			85
bis(2-Chloroethyl)ether	2		0%			85
bis(2-Ethylhexyl)phthalate	2		0%			85
Butylbenzylphthalate	2		0%			85
Chrysene	2		0%			85
Di-n-butylphthalate	2		0%			85
Di-n-octylphthalate	2		0%			85
Dibenzo(a,h)anthracene	2	2	100%	180	400	290
Dibenzofuran	2		0%			85
Diethylphthalate	2		0%			85
Dimethylphthalate	2		0%			85
Fluoranthene	2		0%			85
Fluorene	2		0%			85
Hexachlorobenzene	2		0%			85
Hexachlorobutadiene	2		0%			85
Hexachlorocyclopentadiene	2		0%			85
Hexachloroethane	2		0%			85
Indeno(1,2,3-cd)pyrene	2	2	100%	220	440	330
Isophorone	2		0%			85
n-Nitrosodi-n-propylamine	2		0%			85
N-Nitrosodiphenylamine/Diphenylamine	2		0%			85
Naphthalene	2		0%			85
Nitrobenzene	2		0%			85
Pentachlorophenol	2		0%			210
Phenanthrene	2		0%			85
Phenol	2		0%			85
Pyrene	2		0%			85
Dioxins and Fugrans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	2	2	100%	0.0832	0.0871	0.08515
1,2,3,4,6,7,8,9-OCDF	2	2	100%	0.00062	0.0085	0.00456
1,2,3,4,6,7,8-HpCDD	2	2	100%	0.0021	0.0061	0.0041
1,2,3,4,6,7,8-HpCDF	2	1	50%	0.0014	0.0014	0.00075
1,2,3,4,7,8,9-HpCDF	2		0%			0.0003
1,2,3,4,7,8-HxCDD	2		0%			0.000275
1,2,3,4,7,8-HxCDF	2		0%			0.000175
1,2,3,6,7,8-HxCDD	2		0%			0.00025
1,2,3,6,7,8-HxCDF	2		0%			0.000175
1,2,3,7,8,9-HxCDD	2		0%			0.00025
1,2,3,7,8,9-HxCDF	2		0%			0.0002
1,2,3,7,8-PeCDD	2		0%			0.000225
1,2,3,7,8-PeCDF	2		0%			0.000175
2,3,4,6,7,8-HxCDF	2		0%			0.000175
2,3,4,7,8-PeCDF	2		0%			0.000175
2,3,7,8-TCDD	2		0%			0.000225
2,3,7,8-TCDF	2		0%			0.0002
2,3,7,8-TCDF						
Total HpCDD	2	2	100%	0.0059	0.0127	0.0093
Total HpCDF	2	1	50%	0.0059	0.0059	0.003
Total HxCDD	2	1	50%	0.0014	0.0014	0.0009
Total HxCDF	2		0%			0.000175
Total PeCDD	2		0%			0.000225
Total PeCDF	2		0%			0.000175
Total TCDD	2		0%			0.000225
Total TCDF	2		0%			0.0002

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Borrow Pit Lake Shrimp Tissue Data
Sauget Area I

Compounds	Shrimp BP Comp Concentration	ER Q
Herbicides, ug/kg		
2,4,5-T	10	U
2,4,5-TP (Silvex)	10	U
2,4-D	10	U
2,4-DB	10	U
Dalapon	2000	U
Dicamba	20	U
Dichloroprop	100	U
Dinoseb	100	U
MCPA[(4-chloro-2-methylphenoxy)-acetic a	2000	U
MCPP[2-(4-chloro-2-methylphenoxy)-propan	2000	U
Pentachlorophenol	1.8	J
Aluminum	28	
Antimony	0.16	J
Arsenic	2.0	U
Beryllium	1.0	U
Cadmium	0.50	U
Chromium	0.23	J
Copper	8.3	
Cyanide, Total	10	U
Lead	0.39	J
Mercury	0.095	U
Nickel	10	U
Selenium	0.50	U
Silver	0.090	J
Zinc	16	
% Lipid	0.03	
PCBs and Pesticides, ug/kg		
Decachlorobiphenyl	100	U
Dichlorobiphenyl	20	U
Heptachlorobiphenyl	60	U
Hexachlorobiphenyl	40	U
Monochlorobiphenyl	20	U
Nonachlorobiphenyl	100	U
Octachlorobiphenyl	60	U
Pentachlorobiphenyl	40	U
Tetrachlorobiphenyl	40	U
Trichlorobiphenyl	20	U
Total PCBs	40	U
4,4'-DDD	4.0	U
4,4'-DDE	4.0	U
4,4'-DDT	4.0	U
Total DDT	4	U
Aldrin	2.0	U
Alpha Chlordane	2.0	U
alpha-BHC	2.0	U
beta-BHC	2.0	U
delta-BHC	2.0	U
Dieldrin	4.0	U
Endosulfan I	2.0	U
Endosulfan II	4.0	U
Endosulfan sulfate	4.0	U
Endrin	4.0	U
Endrin aldehyde	4.0	U
Endrin ketone	4.0	U
Gamma Chlordane	2.0	U
gamma-BHC (Lindane)	2.0	U
Heptachlor	2.0	U
Heptachlor epoxide	2.0	U
Methoxychlor	20	U
Toxaphene	110	U
SVOCs, ug/kg		
1,2,4-Trichlorobenzene	340	U
1,2-Dichlorobenzene	340	U
1,3-Dichlorobenzene	340	U
1,4-Dichlorobenzene	340	U

Appendix C-3

Borrow Pit Lake Shrimp Tissue Data
Sauget Area I

Compounds	Shrimp BP Comp Concentration	ER Q
2,2'-Oxybis(1-chloropropane)[bis(2-Chlor	340	U
2,4,5-Trichlorophenol	840	U
2,4,6-Trichlorophenol	340	U
2,4-Dichlorophenol	340	U
2,4-Dimethylphenol	340	U
2,4-Dinitrophenol	840	U
2,4-Dinitrotoluene	340	U
2,6-Dinitrotoluene	340	U
2-Chloronaphthalene	340	U
2-Chlorophenol	340	U
2-Methyl-4,6-dinitrophenol	840	U
2-Methylnaphthalene	340	U
2-Methylphenol (o-cresol)	340	U
2-Nitroaniline	840	U
2-Nitrophenol	340	U
3&4-Methylphenol (m&p-cresol)	340	U
3,3'-Dichlorobenzidine	340	U
3-Nitroaniline	840	U
4-Bromophenylphenyl ether	340	U
4-Chloro-3-methylphenol	340	U
4-Chloroaniline	340	U
4-Chlorophenylphenyl ether	340	U
4-Nitroaniline	840	U
4-Nitrophenol	840	U
Acenaphthene	340	U
Acenaphthylene	340	U
Anthracene	340	U
Benzo(a)anthracene	340	U
Benzo(a)pyrene	340	U
Benzo(b)fluoranthene	340	U
Benzo(g,h,i)perylene	340	U
Benzo(k)fluoranthene	340	U
bis(2-Chloroethoxy)methane	340	U
bis(2-Chloroethyl)ether	340	U
bis(2-Ethylhexyl)phthalate	340	U
Butylbenzylphthalate	340	U
Carbazole	340	U
Chrysene	340	U
Di-n-butylphthalate	340	U
Di-n-octylphthalate	340	U
Dibenzo(a,h)anthracene	340	U
Dibenzofuran	340	U
Diethylphthalate	44	
Dimethylphthalate	340	U
Fluoranthene	340	U
Fluorene	340	U
Hexachlorobenzene	340	U
Hexachlorobutadiene	340	U
Hexachlorocyclopentadiene	340	U
Hexachloroethane	340	U

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Borrow Pit Lake Shrimp Tissue Data
Sauget Area I

Compounds	Shrimp BP Comp Concentration	ER Q
Indeno(1,2,3-cd)pyrene	340	U
Isophorone	340	U
n-Nitrosodi-n-propylamine	340	U
N-Nitrosodiphenylamine/Diphenylamine	340	U
Naphthalene	340	U
Nitrobenzene	340	U
Pentachlorophenol	840	U
Phenanthrene	340	U
Phenol	340	U
Pyrene	340	U
Total PAHs	340	U
Dioxins and Furans, ug/kg		
1,2,3,4,6,7,8,9-OCDD	0.0198	
1,2,3,4,6,7,8,9-OCDF	0.0043	
1,2,3,4,6,7,8-HpCDD	0.0031	
1,2,3,4,6,7,8-HpCDF	0.0015	
1,2,3,4,7,8,9-HpCDF	0.0004	U
1,2,3,4,7,8-HxCDD	0.0003	U
1,2,3,4,7,8-HxCDF	0.0002	U
1,2,3,6,7,8-HxCDD	0.0002	U
1,2,3,6,7,8-HxCDF	0.0002	U
1,2,3,7,8,9-HxCDD	0.0003	U
1,2,3,7,8,9-HxCDF	0.0002	U
1,2,3,7,8-PeCDD	0.0003	U
1,2,3,7,8-PeCDF	0.0002	U
2,3,4,6,7,8-HxCDF	0.0002	U
2,3,4,7,8-PeCDF	0.0002	U
2,3,7,8-TCDD	0.0002	U
2,3,7,8-TCDF	0.0018	
2,3,7,8-TCDF	0.0016	
Total HpCDD	0.0076	
Total HpCDF	0.0046	
Total HxCDD	0.005	
Total HxCDF	0.0028	
Total PeCDD	0.002	
Total PeCDF	0.0025	
Total TCDD	0.0002	U
Total TCDF	0.0049	

Appendix C-3

Summary Statistics for Reference Shrimp Data
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T (ug/kg)	2		0%			5.00
2,4,5-TP (Silvex)	2	1	50%	1.3	1.3	3.15
2,4-D	2		0%			5.00
2,4-DB	2		0%			5.00
Dalapon	2		0%			1000
Dicamba	2		0%			10
Dichloroprop	2		0%			50
Dinoseb	2		0%			50
MCPA[(4-chloro-2-methylphenoxy)-acetic	2		0%			1000
MCPP[2-(4-chloro-2-methylphenoxy)-	2	1	50%	4400	4400	2700
Pentachlorophenol	2	2	100%	1.5	3.9	2.70
Metals, mg/kg						
Aluminum	2	2	100%	60	100	80
Antimony	2		0%			0.09
Arsenic	2	1	50%	1.2	1.2	1.10
Beryllium	2		0%			0.44
Cadmium	2		0%			0.22
Chromium	2	2	100%	0.26	0.28	0.27
Copper	2	2	100%	8.5	16	12
Cyanide, Total	2		0%			5.00
Lead	2	2	100%	0.38	0.61	0.50
Mercury	2		0%			0.04
Nickel	2		0%			4.35
Selenium	2	2	100%	0.47	0.61	0.54
Silver	2	2	100%	0.059	0.062	0.06
Zinc	2	2	100%	15	17	16
% Lipid	2	2	100%	0.27	0.38	0.33
PCBs and Pesticides, ug/kg						
Decachlorobiphenyl	2		0%			50
Dichlorobiphenyl	2		0%			10
Heptachlorobiphenyl	2		0%			30
Hexachlorobiphenyl	2		0%			20
Monochlorobiphenyl	2		0%			10
Nonachlorobiphenyl	2		0%			50
Octachlorobiphenyl	2		0%			30
Pentachlorobiphenyl	2	1	50%	22	22	21
Tetrachlorobiphenyl	2		0%			20
Trichlorobiphenyl	2		0%			10
4,4'-DDD (ug/kg)	2		0%			2.00
4,4'-DDE	2		0%			2.00
4,4'-DDT	2		0%			2.00
Aldrin	2		0%			1.00
Alpha Chlordane	2		0%			1.00
alpha-BHC	2		0%			1.00
beta-BHC	2		0%			1.00
delta-BHC	2		0%			1.00
Dieldrin	2		0%			2.00
Endosulfan I	2		0%			1.00
Endosulfan II	2		0%			2.00
Endosulfan sulfate	2		0%			2.00
Endrin	2		0%			2.00
Endrin aldehyde	2		0%			2.00
Endrin ketone	2		0%			2.00
Gamma Chlordane	2		0%			1.00
gamma-BHC (Lindane)	2		0%			1.00
Heptachlor	2		0%			1.00
Heptachlor epoxide	2		0%			1.00
Methoxychlor	2		0%			10
Toxaphene	2		0%			55
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	2		0%			170
1,2-Dichlorobenzene	2		0%			170
1,3-Dichlorobenzene	2		0%			170
1,4-Dichlorobenzene	2		0%			170
2,2'-Oxybis(1-chloropropane)(bis(2-Chlor	2		0%			170
2,4,5-Trichlorophenol	2		0%			420
2,4,6-Trichlorophenol	2		0%			170
2,4-Dichlorophenol	2		0%			170
2,4-Dimethylphenol	2		0%			170
2,4-Dinitrophenol	2		0%			420
2,4-Dinitrotoluene	2		0%			170
2,6-Dinitrotoluene	2		0%			170
2-Chloronaphthalene	2		0%			170
2-Chlorophenol	2		0%			170
2-Methyl-4,6-dinitrophenol	2		0%			420
2-Methylnaphthalene	2		0%			170
2-Methylphenol (o-cresol)	2		0%			170
2-Nitroaniline	2		0%			420
2-Nitrophenol	2		0%			170
3&4-Methylphenol (m&p-cresol)	2		0%			170
3,3'-Dichlorobenzidine	2		0%			170
3-Nitroaniline	2		0%			420
4-Bromophenylphenyl ether	2		0%			170
4-Chloro-3-methylphenol	2		0%			170
4-Chloroaniline	2		0%			170

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Summary Statistics for Reference Shrimp Data
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
4-Chlorophenylphenyl ether	2		0%			170
4-Nitroaniline	2		0%			420
4-Nitrophenol	2		0%			420
Acenaphthene	2		0%			170
Acenaphthylene	2		0%			170
Anthracene	2		0%			170
Benzo(a)anthracene	2		0%			170
Benzo(a)pyrene	2		0%			170
Benzo(b)fluoranthene	2		0%			170
Benzo(g,h,i)perylene	2		0%			170
Benzo(k)fluoranthene	2		0%			170
bis(2-Chloroethoxy)methane	2		0%			170
bis(2-Chloroethyl)ether	2		0%			170
bis(2-Ethylhexyl)phthalate	2	2	100%	92	98	95
Butylbenzylphthalate	2		0%			170
Carbazole	2		0%			170
Chrysene	2		0%			170
Di-n-butylphthalate	2		0%			170
Di-n-octylphthalate	2		0%			170
Dibenzo(a,h)anthracene	2		0%			170
Dibenzofuran	2		0%			170
Diethylphthalate	2	2	100%	57	59	58
Dimethylphthalate	2		0%			170
Fluoranthene	2		0%			170
Fluorene	2		0%			170
Hexachlorobenzene	2		0%			170
Hexachlorobutadiene	2		0%			170
Hexachlorocyclopentadiene	2		0%			170
Hexachloroethane	2		0%			170
Indeno(1,2,3-cd)pyrene	2		0%			170
Isophorone	2		0%			170
n-Nitrosodi-n-propylamine	2		0%			170
N-Nitrosodiphenylamine/Diphenylamine	2		0%			170
Naphthalene	2		0%			170
Nitrobenzene	2		0%			170
Pentachlorophenol	2		0%			420
Phenanthrene	2		0%			170
Phenol	2		0%			170
Pyrene	2		0%			170
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	2	2	100%	0.0166	0.0299	0.02325
1,2,3,4,6,7,8,9-OCDF	2	1	50%	0.0011	0.0011	0.000675
1,2,3,4,6,7,8-HpCDD	2	2	100%	0.0011	0.0024	0.00175
1,2,3,4,6,7,8-HpCDF	2		0%			0.000125
1,2,3,4,7,8,9-HpCDF	2		0%			0.0002
1,2,3,4,7,8-HxCDD	2		0%			0.000175
1,2,3,4,7,8-HxCDF	2		0%			0.0001
1,2,3,6,7,8-HxCDD	2		0%			0.00015
1,2,3,6,7,8-HxCDF	2		0%			0.0001
1,2,3,7,8,9-HxCDD	2	1	50%	0.00069	0.00069	0.000445
1,2,3,7,8,9-HxCDF	2		0%			0.000125
1,2,3,7,8-PeCDD	2		0%			0.000175
1,2,3,7,8-PeCDF	2		0%			0.000125
2,3,4,6,7,8-HxCDF	2		0%			0.0001
2,3,4,7,8-PeCDF	2		0%			0.000125
2,3,7,8-TCDD	2		0%			0.00015
2,3,7,8-TCDF	2		0%			0.0001
2,3,7,8-TCDF						
Total HpCDD	2	2	100%	0.0035	0.0098	0.00665
Total HpCDF	2	2	100%	0.00037	0.001	0.000685
Total HxCDD	2	2	100%	0.0023	0.0071	0.0047
Total HxCDF	2	2	100%	0.00062	0.0011	0.00086
Total PeCDD	2	2	100%	0.002	0.0042	0.0031
Total PeCDF	2	1	50%	0.00054	0.00054	0.000345
Total TCDD	2	1	50%	0.00053	0.00053	0.00034
Total TCDF	2		0%			0.0001

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Borrow Pit Lake Clam Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	3		0%			22
2,4,5-TP (Silvex)	3		0%			22
2,4-D	3		0%			22
2,4-DB	3		0%			22
Dalapon	3		0%			4333
Dicamba	3		0%			42
Dichloroprop	3	3	100%	3.2	32	18
Dinoseb	3		0%			217
MCPA[(4-chloro-2-	3		0%			4333
MCPP[2-(4-chloro-2-	3	1	33%	4000	4000	5000
Pentachlorophenol	3		0%			43
Metals, mg/kg						
Aluminum	3	3	100%	7.5	13	10.5
Antimony	3		0%			0.09
Arsenic	3	1	33%	0.96	0.96	1.82
Beryllium	3		0%			0.455
Cadmium	3	2	67%	0.074	0.12	0.14
Chromium	3	3	100%	0.22	1.1	0.68
Copper	3	3	100%	0.6	0.99	0.86
Cyanide, Total	3		0%			5
Lead	3	1	33%	0.25	0.25	0.23
Mercury	3		0%			0.04
Nickel	3		0%			4.55
Selenium	3		0%			0.225
Silver	3	1	33%	0.015	0.015	0.04
Zinc	3	3	100%	8.9	22	14.97
% Lipid	3	3	100%	0.05	0.23	0.12
PCB, ug/kg						
Decachlorobiphenyl	3		0%			33.33
Dichlorobiphenyl	3		0%			6.67
Heptachlorobiphenyl	3		0%			20.00
Hexachlorobiphenyl	3		0%			13.33
Monochlorobiphenyl	3		0%			7
Nonachlorobiphenyl	3		0%			33.33
Octachlorobiphenyl	3		0%			20.00
Pentachlorobiphenyl	3		0%			13.33
Tetrachlorobiphenyl	3		0%			13.33
Trichlorobiphenyl	3		0%			7
Total PCBs	3		0%			13.00
Pesticides, ug/kg						
4,4'-DDD	3		0%			12
4,4'-DDE	3		0%			12
4,4'-DDT	3		0%			12
Total DDT	3		0%			12
Aldrin	3		0%			6.12
Alpha Chlordane	3		0%			6.12
alpha-BHC	3		0%			6.12
beta-BHC	3		0%			6.12
delta-BHC	3		0%			6.12
Dieldrin	3		0%			12
Endosulfan I	3		0%			6.12
Endosulfan II	3		0%			12
Endosulfan sulfate	3		0%			12
Endrin	3		0%			12
Endrin aldehyde	3		0%			12
Endrin ketone	3		0%			12
Gamma Chlordane	3		0%			6.12
gamma-BHC (Lindane)	3		0%			6.12
Heptachlor	3	1	33%	2.3	2.3	3.55
Heptachlor epoxide	3		0%			6.12
Methoxychlor	3	1	33%	5.4	5.4	30
Toxaphene	3		0%			327
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	3		0%			113
1,2-Dichlorobenzene	3		0%			113
1,3-Dichlorobenzene	3		0%			113
1,4-Dichlorobenzene	3		0%			113
2,2'-Oxybis(1-	3		0%			113
2,4,5-Trichlorophenol	3		0%			280
2,4,6-Trichlorophenol	3		0%			113
2,4-Dichlorophenol	3		0%			113
2,4-Dimethylphenol	3		0%			113
2,4-Dinitrophenol	3		0%			280
2,4-Dinitrotoluene	3		0%			113
2,6-Dinitrotoluene	3		0%			113
2-Chloronaphthalene	3		0%			113
2-Chlorophenol	3		0%			113
2-Methyl-4,6-dinitrophenol	3		0%			280
2-Methylnaphthalene	3		0%			113
2-Methylphenol (o-cresol)	3		0%			113
2-Nitroaniline	3		0%			280
2-Nitrophenol	3		0%			113
3&4-Methylphenol (m&p-	3		0%			113
3,3'-Dichlorobenzidine	3		0%			113

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Borrow Pit Lake Clam Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
3-Nitroaniline	3		0%			280
4-Bromophenylphenyl ether	3		0%			113
4-Chloro-3-methylphenol	3		0%			113
4-Chloroaniline	3		0%			113
4-Chlorophenylphenyl ether	3		0%			113
4-Nitroaniline	3		0%			280
4-Nitrophenol	3		0%			280
Acenaphthene	3		0%			113
Acenaphthylene	3		0%			113
Anthracene	3		0%			113
Benzo(a)anthracene	3		0%			113
Benzo(a)pyrene	3		0%			113
Benzo(b)fluoranthene	3		0%			113
Benzo(g,h,i)perylene	3		0%			113
Benzo(k)fluoranthene	3		0%			113
bis(2-	3		0%			113
bis(2-Chloroethyl)ether	3		0%			113
bis(2-Ethylhexyl)phthalate	3	3	100%	55	170	99
Butylbenzylphthalate	3		0%			113
Carbazole	3		0%			113
Chrysene	3		0%			113
Di-n-butylphthalate	3		0%			113
Di-n-octylphthalate	3		0%			113
Dibenzo(a,h)anthracene	3		0%			113
Dibenzofuran	3		0%			113
Diethylphthalate	3	3	100%	53	120	75
Dimethylphthalate	3		0%			113
Fluoranthene	3		0%			113
Fluorene	3		0%			113
Hexachlorobenzene	3		0%			113
Hexachlorobutadiene	3		0%			113
Hexachlorocyclopentadiene	3		0%			113
Hexachloroethane	3		0%			113
Indeno(1,2,3-cd)pyrene	3		0%			113
Isophorone	3		0%			113
n-Nitrosodi-n-propylamine	3		0%			113
N-	3		0%			113
Naphthalene	3		0%			113
Nitrobenzene	3		0%			113
Pentachlorophenol	3		0%			280
Phenanthrene	3		0%			113
Phenol	3		0%			113
Pyrene	3		0%			113
Total PAHs	3		0%			113
Dioxins and Furans,						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	0.0034	0.0151	0.008066667
1,2,3,4,6,7,8,9-OCDF	3		0%			0.000366667
1,2,3,4,6,7,8-HpCDD	3	1	33%	0.0014	0.0014	0.000616667
1,2,3,4,6,7,8-HpCDF	3		0%			0.000166667
1,2,3,4,7,8,9-HpCDF	3		0%			0.00025
1,2,3,4,7,8-HxCDD	3		0%			0.0002
1,2,3,4,7,8-HxCDF	3		0%			0.000116667
1,2,3,6,7,8-HxCDD	3		0%			0.000166667
1,2,3,6,7,8-HxCDF	3		0%			0.0001
1,2,3,7,8,9-HxCDD	3		0%			0.0002
1,2,3,7,8,9-HxCDF	3		0%			0.000133333
1,2,3,7,8-PeCDD	3		0%			0.000133333
1,2,3,7,8-PeCDF	3		0%			0.0001
2,3,4,6,7,8-HxCDF	3		0%			0.0001
2,3,4,7,8-PeCDF	3		0%			0.0001
2,3,7,8-TCDD	3		0%			0.0001
2,3,7,8-TCDF	1	1	100%	0.001	0.001	0.001
2,3,7,8-TCDF	3	3	100%	0.00031	0.0015	0.000823333
Total HpCDD	3	1	33%	0.0034	0.0034	0.001283333
Total HpCDF	3		0%			0.0002
Total HxCDD	3	1	33%	0.00055	0.00055	0.000283333
Total HxCDF	3		0%			0.000116667
Total PeCDD	3		0%			0.000133333
Total PeCDF	3	2	67%	0.0013	0.0014	0.000916667
Total TCDD	3	3	100%	0.00017	0.0014	0.00089
Total TCDF	3	3	100%	0.00093	0.008	0.00451

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Reference Area Clam Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
Herbicides, ug/kg						
2,4,5-T	3		0%			20
2,4,5-TP (Silvex)	3		0%			20
2,4-D	3		0%			20
2,4-DB	3		0%			20
Dalapon	3		0%			4000
Dicamba	3		0%			40
Dichloroprop	3	3	100%	6.50	87.00	35
Dinoseb	3		0%			200
MCPA[(4-chloro-2-methylphenoxy)-acetic a	3	1	33%	1,400.00	1,400.00	7467
MCPP[2-(4-chloro-2-methylphenoxy)-	3		0%			7333
Pentachlorophenol	3		0%			40
Metals, mg/kg						
Aluminum	3	3	100%	14.00	26.00	18.33
Antimony	3		0%			0.09
Arsenic	3	1	33%	0.65	0.65	1.75
Beryllium	3		0%			0.47
Cadmium	3	3	100%	0.16	0.61	0.43
Chromium	3	3	100%	0.79	2.20	1.50
Copper	3	3	100%	1.60	2.40	2.13
Cyanide, Total	3		0%			5.00
Lead	3	2	67%	0.44	0.59	0.42
Mercury	3		0%			0.04
Nickel	3		0%			4.70
Selenium	3	1	33%	0.48	0.48	0.31
Silver	3		0%			0.05
Zinc	3	3	100%	21.00	52.00	36.00
% Lipid	3	3	100%	0.09	0.12	0.11
PCB, ug/kg						
Decachlorobiphenyl	3		0%			25.00
Dichlorobiphenyl	3		0%			5.00
Heptachlorobiphenyl	3		0%			15.00
Hexachlorobiphenyl	3		0%			10.00
Monochlorobiphenyl	3		0%			5.00
Nonachlorobiphenyl	3		0%			25.00
Octachlorobiphenyl	3		0%			15.00
Pentachlorobiphenyl	3		0%			10.00
Tetrachlorobiphenyl	3		0%			10.00
Trichlorobiphenyl	3		0%			5.00
Total PCBs						
Pesticides, ug/kg	3		0%			9.55
4,4'-DDD	3		0%			9.55
4,4'-DDE	3		0%			9.55
4,4'-DDT	3		0%			5.12
Aldrin	3		0%			5.12
Alpha Chlordane	3		0%			5.12
alpha-BHC	3		0%			5.12
beta-BHC	3		0%			5.12
delta-BHC	3		0%			9.55
Dieldrin	3		0%			5.12
Endosulfan I	3		0%			9.55
Endosulfan II	3		0%			9.55
Endosulfan sulfate	3		0%			9.55
Endrin	3		0%			9.55
Endrin aldehyde	3		0%			9.55
Endrin ketone	3		0%			5.12
Gamma Chlordane	3		0%			5.12
gamma-BHC (Lindane)	3		0%			5.12
Heptachlor	3		0%			5.12
Heptachlor epoxide	3		0%			51.17
Methoxychlor	3		0%			263.33
Toxaphene	3		0%			85.00
SVOCs, ug/kg						
1,2,4-Trichlorobenzene	3		0%			85
1,2-Dichlorobenzene	3		0%			85
1,3-Dichlorobenzene	3		0%			85
1,4-Dichlorobenzene	3		0%			85
2,2'-Oxybis(1-chloropropane)(bis(2-Chlor	3		0%			210
2,4,5-Trichlorophenol	3		0%			85
2,4,6-Trichlorophenol	3		0%			85
2,4-Dichlorophenol	3		0%			85
2,4-Dimethylphenol	3		0%			210
2,4-Dinitrophenol	3		0%			85
2,4-Dinitrotoluene	3		0%			85
2,6-Dinitrotoluene	3		0%			85
2-Chloronaphthalene	3		0%			85
2-Chlorophenol	3		0%			210
2-Methyl-4,6-dinitrophenol	3		0%			85
2-Methylnaphthalene	3		0%			85
2-Methylphenol (o-cresol)	3		0%			210
2-Nitroaniline	3		0%			85
2-Nitrophenol	3		0%			85
3&4-Methylphenol (m&p-cresol)	3		0%			85
3,3'-Dichlorobenzidine	3		0%			210
3-Nitroaniline	3		0%			85

Appendix C-3

Reference Area Clam Summary Statistics
Sauget Area I

Compounds	Number Analyzed	Number Detected	Frequency of Detection	Minimum Detected	Maximum Detected	Average Concentration
4-Bromophenylphenyl ether	3		0%			85
4-Chloro-3-methylphenol	3		0%			85
4-Chloroaniline	3		0%			85
4-Chlorophenylphenyl ether	3		0%			210
4-Nitroaniline	3		0%			210
4-Nitrophenol	3		0%			85
Acenaphthene	3		0%			85
Acenaphthylene	3		0%			85
Anthracene	3		0%			85
Benzo(a)anthracene	3		0%			85
Benzo(a)pyrene	3		0%			85
Benzo(b)fluoranthene	3		0%			85
Benzo(g,h,i)perylene	3		0%			85
Benzo(k)fluoranthene	3		0%			85
bis(2-Chloroethoxy)methane	3		0%			85
bis(2-Chloroethyl)ether	3	3	100%	47.00	73.00	62
bis(2-Ethylhexyl)phthalate	3		0%			85
Butylbenzylphthalate	3		0%			85
Carbazole	3		0%			85
Chrysene	3		0%			85
Di-n-butylphthalate	3		0%			85
Di-n-octylphthalate	3		0%			85
Dibenzo(a,h)anthracene	3		0%			85
Dibenzofuran	3	3	100%	49.00	59.00	53
Diethylphthalate	3		0%			85
Dimethylphthalate	3		0%			85
Fluoranthene	3		0%			85
Fluorene	3		0%			85
Hexachlorobenzene	3		0%			85
Hexachlorobutadiene	3		0%			85
Hexachlorocyclopentadiene	3		0%			85
Hexachloroethane	3		0%			85
Indeno(1,2,3-cd)pyrene	3		0%			85
Isophorone	3		0%			85
n-Nitrosodi-n-propylamine	3		0%			85
N-Nitrosodiphenylamine/Diphenylamine	3		0%			85
Naphthalene	3		0%			85
Nitrobenzene	3		0%			210
Pentachlorophenol	3		0%			85
Phenanthrene	3		0%			85
Phenol	3		0%			85
Pyrene	3	3	100%	0.01	0.01	0.01
Total PAHs						
Dioxins and Furans, ug/kg						
1,2,3,4,6,7,8,9-OCDD	3	3	100%	0.0068	0.0124	0.0098
1,2,3,4,6,7,8,9-OCDF	3	1	33%	0.0018	0.0018	0.00085
1,2,3,4,6,7,8-HpCDD	3	2	67%	0.00059	0.001	0.000663333
1,2,3,4,6,7,8-HpCDF	3		0%			0.000166667
1,2,3,4,7,8,9-HpCDF	3		0%			0.00025
1,2,3,4,7,8-HxCDD	3		0%			0.000166667
1,2,3,4,7,8-HxCDF	3		0%			0.0001
1,2,3,6,7,8-HxCDD	3		0%			0.000166667
1,2,3,6,7,8-HxCDF	3		0%			0.0001
1,2,3,7,8,9-HxCDD	3		0%			0.0002
1,2,3,7,8,9-HxCDF	3		0%			0.00015
1,2,3,7,8-PeCDD	3		0%			0.00015
1,2,3,7,8-PeCDF	3		0%			0.0001
2,3,4,6,7,8-HxCDF	3		0%			0.0001
2,3,4,7,8-PeCDF	3		0%			0.0001
2,3,7,8-TCDD	3		0%			0.0001
2,3,7,8-TCDF						
2,3,7,8-TCDF	3	1	33%	0.00025	0.00025	0.000166667
Total HpCDD	3	2	67%	0.0011	0.0024	0.0013
Total HpCDF	3		0%			0.0002
Total HxCDD	3	1	33%	0.00026	0.00026	0.00022
Total HxCDF	3		0%			0.0001
Total PeCDD	3		0%			0.00015
Total PeCDF	3	2	67%	0.00025	0.0021	0.000816667
Total TCDD	3	3	100%	0.00007	0.0037	0.002023333
Total TCDF	3	2	67%	0.0014	0.0017	0.001066667

Appendix C-4

Summary Statistics for Background Surface Soil
Sauget Area I

Area	Medium	Method	Constituent	Units	Number of Samples Analyzed
Background	Surface Soil	8280A	1998 Total TEQ w/ EMPC as ND	ppb	3
Background	Surface Soil	HERB	MCPP[2-(4-chloro-2-methylphenoxy)-propan	ug/kg dw	3
Background	Surface Soil	HERB	2,4,5-TP (Silvex)	ug/kg dw	3
Background	Surface Soil	HERB	MCPA[(4-chloro-2-methylphenoxy)-acetic a	ug/kg dw	3
Background	Surface Soil	METALS	Aluminum	mg/kg dw	3
Background	Surface Soil	METALS	Iron	mg/kg dw	3
Background	Surface Soil	METALS	Lead	mg/kg dw	3
Background	Surface Soil	METALS	Magnesium	mg/kg dw	3
Background	Surface Soil	METALS	Manganese	mg/kg dw	3
Background	Surface Soil	METALS	Mercury	mg/kg dw	3
Background	Surface Soil	METALS	Molybdenum	mg/kg dw	3
Background	Surface Soil	METALS	Nickel	mg/kg dw	3
Background	Surface Soil	METALS	Potassium	mg/kg dw	3
Background	Surface Soil	METALS	Silver	mg/kg dw	3
Background	Surface Soil	METALS	Sodium	mg/kg dw	3
Background	Surface Soil	METALS	Antimony	mg/kg dw	1
Background	Surface Soil	METALS	Arsenic	mg/kg dw	3
Background	Surface Soil	METALS	Barium	mg/kg dw	3
Background	Surface Soil	METALS	Beryllium	mg/kg dw	3
Background	Surface Soil	METALS	Cadmium	mg/kg dw	3
Background	Surface Soil	METALS	Chromium	mg/kg dw	3
Background	Surface Soil	METALS	Cobalt	mg/kg dw	3
Background	Surface Soil	METALS	Copper	mg/kg dw	3
Background	Surface Soil	METALS	Vanadium	mg/kg dw	3
Background	Surface Soil	METALS	Zinc	mg/kg dw	3
Background	Surface Soil	METALS	Calcium	mg/kg dw	3
Background	Surface Soil	PCB	Total PCBs	ug/kg dw	3
Background	Surface Soil	PEST	4,4'-DDT	ug/kg dw	3
Background	Surface Soil	PEST	4,4'-DDE	ug/kg dw	3
Background	Surface Soil	SVOA	bis(2-Ethylhexyl)phthalate	ug/kg dw	3
Background	Surface Soil	SVOA	Anthracene	ug/kg dw	3
Background	Surface Soil	SVOA	Pyrene	ug/kg dw	3
Background	Surface Soil	SVOA	Benzo(g,h,i)perylene	ug/kg dw	3
Background	Surface Soil	SVOA	Benzo(b)fluoranthene	ug/kg dw	3
Background	Surface Soil	SVOA	Fluoranthene	ug/kg dw	3
Background	Surface Soil	SVOA	Benzo(k)fluoranthene	ug/kg dw	3
Background	Surface Soil	SVOA	Chrysene	ug/kg dw	3
Background	Surface Soil	SVOA	Benzo(a)pyrene	ug/kg dw	3
Background	Surface Soil	SVOA	Benzo(a)anthracene	ug/kg dw	3
Background	Surface Soil	SVOA	Diethylphthalate	ug/kg dw	3
Background	Surface Soil	SVOA	Di-n-butylphthalate	ug/kg dw	3
Background	Surface Soil	SVOA	Phenanthrene	ug/kg dw	3
Background	Surface Soil	SVOA	Carbazole	ug/kg dw	3
Background	Surface Soil	SVOA	Pentachlorophenol	ug/kg dw	3
Background	Surface Soil	VOA	2-Hexanone	ug/kg dw	3
Background	Surface Soil	VOA	Methylene chloride (Dichloromethane)	ug/kg dw	3

Summary Statistics for Background Surface Soil
Sauget Area I

Number of Detects	Frequency of Detection	Number of Samples for Statistics	Shapiro-Wilke's Test for Normality(a)			Summary Statistics		
			Normal	Lognormal	Dataset Distribution	Minimum	Mean	Maximum
3	100%	3	0.77	0.87	Lognormal	0.0047	0.062	0.17
3	100%	3	0.87	0.83	Normal	2500	4983	6550
3	100%	3	0.97	0.93	Normal	5.8	8.7	11
3	100%	3	0.76	0.77	Lognormal	4300	7250	13000
3	100%	3	0.93	0.97	Lognormal	8100	12700	19000
3	100%	3	0.89	0.92	Lognormal	15000	19000	25000
3	100%	3	0.96	1.00	Lognormal	24	93	180
3	100%	3	0.88	0.97	Lognormal	3200	8617	17000
3	100%	3	0.80	0.81	Lognormal	390	442	535
3	100%	3	0.99	1.00	Lognormal	0.044	0.089	0.14
3	100%	3	0.94	0.97	Lognormal	0.72	1.0	1.4
3	100%	3	1.00	1.00	Normal	15	21	28
3	100%	3	1.00	0.99	Normal	1300	2367	3500
2	67%	3	0.97	1.00	Lognormal	0.33	0.68	1.1
1	33%	3	0.77	0.82	Lognormal	50	288	750
1	100%	1	NC	NC	NC	1.9	1.9	1.9
3	100%	3	0.98	1.00	Lognormal	6.6	9.6	13
3	100%	3	0.94	0.90	Normal	110	182	235
3	100%	3	0.99	1.00	Lognormal	0.45	0.75	1.10
3	100%	3	0.94	0.98	Lognormal	0.52	4.3	9.4
3	100%	3	0.75	0.75	Lognormal	17	20	25
3	100%	3	0.98	1.00	Lognormal	5.5	7.8	10
3	100%	3	0.97	1.00	Lognormal	35	105	190
3	100%	3	0.88	0.91	Lognormal	28	35	45
3	100%	3	0.95	0.99	Lognormal	82	404	820
3	100%	3	0.80	0.89	Lognormal	4000	16767	40000
2	67%	3	0.78	0.99	Lognormal	10	600	1706
1	33%	3	0.76	0.78	Lognormal	2	7.1	17
1	33%	3	0.76	0.78	Lognormal	2	8.1	20
2	67%	3	0.77	0.79	Lognormal	105	161	268
1	33%	1	NC	NC	NC	80	80	80
2	67%	3	0.94	0.99	Lognormal	113	218	360
2	67%	2	1.00	1.00	Lognormal	45	64	82
2	67%	2	1.00	1.00	Lognormal	69	90	110
2	67%	3	0.93	0.99	Lognormal	113	251	440
2	67%	3	0.97	0.93	Normal	60	104	140
2	67%	3	0.86	0.90	Lognormal	97	137	200
2	67%	3	0.83	0.87	Lognormal	60	93	150
2	67%	3	0.98	1.00	Lognormal	77	120	170
3	100%	3	0.75	0.75	Normal	60	93	110
2	67%	3	0.85	0.88	Lognormal	105	156	240
2	67%	3	0.80	0.83	Lognormal	100	168	290
1	33%	1	NC	NC	NC	32	32	32
2	67%	3	0.85	0.89	Lognormal	255	371	561
1	33%	3	0.94	0.93	Normal	15	17	18
2	67%	3	0.87	0.97	Lognormal	1.7	5.7	12

Appendix C-4

Summary Statistics for Background Surface Soil
Sauget Area I

95% Upper Confidence Limit			
t-Test	H-Test	UCL (b)	Site Concentration (c)
0.223	9.55E+13	9.6E+13	0.17
8650	68736	8650	6550
13.1	25.1	13	11
15646	292736	292736	13000
22217	72950	72950	19000
27921	39542	39542	25000
227	1379198	1379198	180
21029	7465777	7465777	17000
578	657	657	535
0.170	2.06	2.1	0.14
1.60	3.02	3.0	1.4
32.3	55.4	32	28
4224	23958	4224	3500
1.34	22.0	22	1.1
962	3.67E+11	3.7E+11	750
NC	NC	NC	1.9
15.0	29.0	29	13
290	820	290	235
1.30	4.90	4.9	1.1
12.0	2.50E+09	2.5E+09	9.4
27.5	34.3	34	25
11.9	20.9	21	10
237	89789	89789	190
49.3	65.3	65	45
1041	1.23E+08	1.2E+08	820
50743	1.95E+10	2.0E+10	40000
2216	1.91E+30	1.9E+30	1706
21.6	6841810	6841810	17
25.5	72182392	72182392	20
317	2148	2148	268
NC	NC	NC	80
433	5367	5367	360
180	NC	NC	82
219	NC	NC	110
537	20368	20368	440
173	642	173	140
230	542	542	200
176	883	883	150
199	525	525	170
142	303	142	110
280	951	951	240
347	4038	4038	290
NC	NC	NC	32
650	1897	1897	561
20	21	20	18
15	58320	58320	12

Appendix C-4

Summary Statistics for Floodplain Surface Soil
Sauget Area I

Area	Medium	Method	Constituent	Units	Number of Samples Analyzed	Number of Detects	Frequency of Detection	Number of Samples for Statistics
Combined	Surface Soil	8280A	1998 Total TEQ w/ EMPC as ND	ug/kg dw	29	29	100%	29
Combined	Surface Soil	HERB	Dicamba	ug/kg dw	65	15	23%	16
Combined	Surface Soil	HERB	MCPP	ug/kg dw	65	10	15%	65
Combined	Surface Soil	HERB	MCPA	ug/kg dw	65	13	20%	65
Combined	Surface Soil	HERB	2,4-D	ug/kg dw	65	1	2%	2
Combined	Surface Soil	HERB	2,4-DB	ug/kg dw	65	4	6%	65
Combined	Surface Soil	METALS	Aluminum	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Iron	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Lead	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Magnesium	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Manganese	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Mercury	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Molybdenum	mg/kg dw	65	64	98%	65
Combined	Surface Soil	METALS	Nickel	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Potassium	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Silver	mg/kg dw	65	32	49%	65
Combined	Surface Soil	METALS	Thallium	mg/kg dw	65	17	26%	65
Combined	Surface Soil	METALS	Antimony	mg/kg dw	65	27	42%	65
Combined	Surface Soil	METALS	Arsenic	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Barium	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Beryllium	mg/kg dw	65	55	85%	65
Combined	Surface Soil	METALS	Cadmium	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Chromium	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Cobalt	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Copper	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Vanadium	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Zinc	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Calcium	mg/kg dw	65	65	100%	65
Combined	Surface Soil	METALS	Selenium	mg/kg dw	65	16	25%	65
Combined	Surface Soil	PCB	Total PCBs	ug/kg dw	65	53	82%	65
Combined	Surface Soil	PEST	Heptachlor epoxide	ug/kg dw	65	16	25%	65
Combined	Surface Soil	PEST	Endosulfan sulfate	ug/kg dw	65	12	18%	40
Combined	Surface Soil	PEST	Aldrin	ug/kg dw	65	1	2%	65
Combined	Surface Soil	PEST	alpha-BHC	ug/kg dw	65	1	2%	1
Combined	Surface Soil	PEST	beta-BHC	ug/kg dw	65	7	11%	65
Combined	Surface Soil	PEST	delta-BHC	ug/kg dw	65	5	8%	5
Combined	Surface Soil	PEST	Endosulfan II	ug/kg dw	65	1	2%	1
Combined	Surface Soil	PEST	4,4'-DDT	ug/kg dw	65	31	48%	65
Combined	Surface Soil	PEST	Alpha Chlordane	ug/kg dw	65	13	20%	65
Combined	Surface Soil	PEST	Gamma Chlordane	ug/kg dw	65	14	22%	65
Combined	Surface Soil	PEST	Endrin ketone	ug/kg dw	65	24	37%	61
Combined	Surface Soil	PEST	gamma-BHC (Lindane)	ug/kg dw	65	2	3%	2
Combined	Surface Soil	PEST	Dieldrin	ug/kg dw	65	19	29%	65
Combined	Surface Soil	PEST	Endrin	ug/kg dw	65	4	6%	60
Combined	Surface Soil	PEST	Methoxychlor	ug/kg dw	65	24	37%	62
Combined	Surface Soil	PEST	4,4'-DDD	ug/kg dw	65	5	8%	65
Combined	Surface Soil	PEST	4,4'-DDE	ug/kg dw	65	35	54%	65
Combined	Surface Soil	PEST	Endrin aldehyde	ug/kg dw	65	3	5%	60
Combined	Surface Soil	PEST	Heptachlor	ug/kg dw	65	4	6%	65
Combined	Surface Soil	SVOA	bis(2-Ethylhexyl)phthalate	ug/kg dw	65	19	29%	65
Combined	Surface Soil	SVOA	Anthracene	ug/kg dw	65	15	23%	65
Combined	Surface Soil	SVOA	Pyrene	ug/kg dw	65	32	49%	65
Combined	Surface Soil	SVOA	Dibenzofuran	ug/kg dw	65	5	8%	65
Combined	Surface Soil	SVOA	Benzo(g,h,i)perylene	ug/kg dw	65	24	37%	65
Combined	Surface Soil	SVOA	Indeno(1,2,3-cd)pyrene	ug/kg dw	65	18	28%	65
Combined	Surface Soil	SVOA	Benzo(b)fluoranthene	ug/kg dw	65	36	55%	65
Combined	Surface Soil	SVOA	Fluoranthene	ug/kg dw	65	39	60%	65
Combined	Surface Soil	SVOA	Benzo(k)fluoranthene	ug/kg dw	65	26	40%	65
Combined	Surface Soil	SVOA	Acenaphthylene	ug/kg dw	65	4	6%	4
Combined	Surface Soil	SVOA	Chrysene	ug/kg dw	65	41	63%	65
Combined	Surface Soil	SVOA	Benzo(a)pyrene	ug/kg dw	65	26	40%	65
Combined	Surface Soil	SVOA	Dibenzo(a,h)anthracene	ug/kg dw	65	12	18%	65
Combined	Surface Soil	SVOA	Benzo(a)anthracene	ug/kg dw	65	37	57%	65
Combined	Surface Soil	SVOA	Acenaphthene	ug/kg dw	65	9	14%	65
Combined	Surface Soil	SVOA	Diethylphthalate	ug/kg dw	65	1	2%	1
Combined	Surface Soil	SVOA	Di-n-butylphthalate	ug/kg dw	65	10	15%	65

Appendix C-4

Summary Statistics for Floodplain Surface Soil
Sauget Area I

Area	Medium	Method	Constituent	Units	Number of Samples Analyzed	Number of Detects	Frequency of Detection	Number of Samples for Statistics
Combined	Surface Soil	SVOA	Phenanthrene	ug/kg dw	65	34	52%	65
Combined	Surface Soil	SVOA	Butylbenzylphthalate	ug/kg dw	65	3	5%	65
Combined	Surface Soil	SVOA	Fluorene	ug/kg dw	65	7	11%	65
Combined	Surface Soil	SVOA	Carbazole	ug/kg dw	65	11	17%	65
Combined	Surface Soil	SVOA	Pentachlorophenol	ug/kg dw	65	36	55%	65
Combined	Surface Soil	SVOA	Naphthalene	ug/kg dw	65	2	3%	2
Combined	Surface Soil	SVOA	2-Methylnaphthalene	ug/kg dw	65	3	5%	3
Combined	Surface Soil	VOA	Ethylbenzene	ug/kg dw	65	1	2%	47
Combined	Surface Soil	VOA	Toluene	ug/kg dw	65	13	20%	65
Combined	Surface Soil	VOA	Chlorobenzene	ugkg dw	65	1	2%	64
Combined	Surface Soil	VOA	Xylenes, Total	ug/kg dw	65	1	2%	65
Combined	Surface Soil	VOA	2-Hexanone	ug/kg dw	65	3	5%	3
Combined	Surface Soil	VOA	Acetone	ug/kg dw	65	32	49%	65
Combined	Surface Soil	VOA	Benzene	ug/kg dw	65	5	8%	65
Combined	Surface Soil	VOA	Methylene chloride (Dichloromethane)	ug/kg dw	65	3	5%	8
Combined	Surface Soil	VOA	Carbon disulfide	ug/kg dw	65	3	5%	65
Combined	Surface Soil	VOA	2-Butanone (MEK)	ug/kg dw	65	23	35%	65
Combined	Surface Soil	VOA	Trichloroethene	ug/kg dw	65	4	6%	65

Summary Statistics for Floodplain Surface Soil
Sauget Area I

Shapiro-Wilke's Test for Normality(a)			Summary Statistics			95% Upper Confidence Limit			
Normal	Lognormal	Dataset Distribution	Minimum	Mean	Maximum	t-Test	H-Test	UCL (b)	Site Concentration (c)
0.57	0.96	Lognormal	0.0014	0.0083	0.052	0.0114	0.0107	0.011	0.011
0.44	0.75	Lognormal	1 3	3.6	23	5.94	4.90	4.9	4.9
NA, n>50	NA, n>50	Lognormal	1000	1736	7700	2050	1859	1859	1859
NA, n>50	NA, n>50	Lognormal	1000	1663	7400	1935	1784	1784	1784
1.00	1.00	Lognormal	3.6	6.6	9.6	25.5	NC	NC	9.6
NA, n>50	NA, n>50	Lognormal	4.3	6.4	41	7.72	6.62	6.6	6.6
NA, n>50	NA, n>50	Lognormal	3300	9391	18000	10046	10122	10122	10122
NA, n>50	NA, n>50	Lognormal	4100	15327	25000	16112	16348	16348	16348
NA, n>50	NA, n>50	Lognormal	24	71	260	79.5	79	79	79
NA, n>50	NA, n>50	Lognormal	2800	5953	21000	6692	6448	6448	6448
NA, n>50	NA, n>50	Lognormal	120	398	1200	429	429	429	429
NA, n>50	NA, n>50	Lognormal	0.027	0.076	0.57	0.0899	0.0809	0.081	0.081
NA, n>50	NA, n>50	Lognormal	0.22	0.73	3.2	0.832	0.814	0.81	0.81
NA, n>50	NA, n>50	Lognormal	12	19	55	20.3	20.0	20	20
NA, n>50	NA, n>50	Lognormal	1200	2017	3800	2134	2135	2135	2135
NA, n>50	NA, n>50	Lognormal	0.20	0.45	0.60	0.476	0.486	0.49	0.49
NA, n>50	NA, n>50	Lognormal	0.49	0.64	1.4	0.685	0.677	0.68	0.68
NA, n>50	NA, n>50	Lognormal	0.32	1.1	2.6	1.23	1.24	1.2	1.2
NA, n>50	NA, n>50	Lognormal	2.6	7.4	34	8.18	7.88	7.9	7.9
NA, n>50	NA, n>50	Lognormal	40	186	1200	214	198	198	198
NA, n>50	NA, n>50	Lognormal	0.17	0.56	1.1	0.607	0.619	0.62	0.62
NA, n>50	NA, n>50	Lognormal	0.46	2.4	8.4	2.72	2.77	2.8	2.8
NA, n>50	NA, n>50	Lognormal	11	17	49	18.3	17.9	18	18
NA, n>50	NA, n>50	Lognormal	2.3	6.6	11	6.94	7.01	7.0	7.0
NA, n>50	NA, n>50	Lognormal	18	70	230	79.3	81	81	81
NA, n>50	NA, n>50	Lognormal	13	28	120	31.0	30	30	30
NA, n>50	NA, n>50	Lognormal	76	294	1400	340	332	332	332
NA, n>50	NA, n>50	Lognormal	3500	26070	250000	35276	30365	30365	30365
NA, n>50	NA, n>50	Lognormal	0.48	0.63	3.2	0.707	0.661	0.66	0.66
NA, n>50	NA, n>50	Lognormal	7.50	64	385	77.1	90.4	90	90
NA, n>50	NA, n>50	Lognormal	0.090	1.7	30	2.54	2.04	2.0	2.0
0.66	0.62	Normal	0.093	1.4	1.9	1.60	2.51	1.6	1.6
NA, n>50	NA, n>50	Lognormal	0.90	1.7	23	2.34	1.68	1.7	1.7
NC	NC	NC	0.22	0.22	0.22	NC	NC	NC	0.22
NA, n>50	NA, n>50	Lognormal	0.10	0.50	3.8	0.628	0.542	0.54	0.54
0.98	0.96	Normal	0.082	0.16	0.24	0.216	0.282	0.22	0.22
NC	NC	NC	1.0	1.0	1.0	NC	NC	NC	1.0
NA, n>50	NA, n>50	Lognormal	0.12	8 8	140	14.3	7.95	8.0	8.0
NA, n>50	NA, n>50	Lognormal	0.16	2.7	54	4.19	2.55	2.6	2.6
NA, n>50	NA, n>50	Lognormal	0.10	4.1	78	6.77	3.26	3.3	3.3
NA, n>50	NA, n>50	Lognormal	0.12	1.6	4.9	1.83	2.56	2.6	2.6
1.00	1.00	Lognormal	0.087	0.11	0.13	0.244	NC	NC	0.13
NA, n>50	NA, n>50	Lognormal	0.089	4.3	120	7.32	3.86	3.9	3.9
NA, n>50	NA, n>50	Lognormal	0.10	2.0	6.1	2.13	2.31	2.3	2.3
NA, n>50	NA, n>50	Lognormal	0.93	8.7	38	9.92	11.6	12	11.6
NA, n>50	NA, n>50	Lognormal	0.56	3.0	36	3.93	3.01	3.0	3.0
NA, n>50	NA, n>50	Lognormal	0.086	3.2	54	4.76	4.04	4.0	4.0
NA, n>50	NA, n>50	Lognormal	0.24	2 0	5.1	2.10	2.16	2.2	2.2
NA, n>50	NA, n>50	Lognormal	0.34	2 8	91	5.11	1.98	2.0	2.0
NA, n>50	NA, n>50	Lognormal	29	104	430	116	111	111	111
NA, n>50	NA, n>50	Lognormal	26	158	2300	225	152	152	152
NA, n>50	NA, n>50	Lognormal	72	533	8500	840	443	443	443
NA, n>50	NA, n>50	Lognormal	45	109	770	127	112	112	112
NA, n>50	NA, n>50	Lognormal	38	197	2200	267	201	201	201
NA, n>50	NA, n>50	Lognormal	51	192	2000	255	195	195	195
NA, n>50	NA, n>50	Lognormal	27	303	4400	455	282	282	282
NA, n>50	NA, n>50	Lognormal	37	648	10000	1029	558	558	558
NA, n>50	NA, n>50	Lognormal	37	272	3400	401	249	249	249
0.96	0.99	Lognormal	24	46	75	71.6	174	174	75
NA, n>50	NA, n>50	Lognormal	28	340	4900	518	319	319	319
NA, n>50	NA, n>50	Lognormal	43	261	3600	399	226	226	226
NA, n>50	NA, n>50	Lognormal	26	89	810	116	90	90	90
NA, n>50	NA, n>50	Lognormal	23	293	4300	451	266	266	266
NA, n>50	NA, n>50	Lognormal	16	119	1200	149	124	124	124
NC	NC	NC	39	39	39	NC	NC	NC	39
NA, n>50	NA, n>50	Lognormal	32	95	170	98.4	100	100	100

Appendix C-4

Summary Statistics for Floodplain Surface Soil
Sauget Area I

Shapiro-Wilke's Test for Normality(a)			Summary Statistics			95% Upper Confidence Limit			
Normal	Lognormal	Dataset Distribution	Minimum	Mean	Maximum	t-Test	H-Test	UCL (b)	Site Concentration (c)
NA, n>50	NA, n>50	Lognormal	22	461	9200	764	366	366	366
NA, n>50	NA, n>50	Lognormal	57	100	340	106	103	103	103
NA, n>50	NA, n>50	Lognormal	44	126	1400	161	126	126	126
NA, n>50	NA, n>50	Lognormal	58	125	1000	156	127	127	127
NA, n>50	NA, n>50	Lognormal	221	267	740	284	278	278	278
1.00	1.00	Normal	41	60	79	180	NC	180	79
0.96	0.97	Lognormal	62	66	72	75.2	NC	NC	72
0.93	0.90	Normal	2.1	2.7	3.0	2.78	NC	2.8	2.8
NA, n>50	NA, n>50	Lognormal	2.1	3.2	12	3.48	3.34	3.3	3.3
NA, n>50	NA, n>50	Lognormal	2.1	2.9	4.0	2.95	2.95	3.0	3.0
NA, n>50	NA, n>50	Lognormal	2.1	2.9	4.2	2.99	2.99	3.0	3.0
0.85	0.84	Normal	4.8	6.1	6.9	8.01	9.73	8.0	6.9
NA, n>50	NA, n>50	Lognormal	21	177	670	216	283	283	283
NA, n>50	NA, n>50	Lognormal	1.8	2.9	4.8	2.97	2.97	3.0	3.0
0.9075	0.9062	Normal	1.8	2.2	2.4	2.36	2.40	2.4	2.4
NA, n>50	NA, n>50	Lognormal	2.1	2.9	4.3	2.99	2.98	3.0	3.0
NA, n>50	NA, n>50	Lognormal	9.1	19	47	21.0	20.9	21	21
NA, n>50	NA, n>50	Lognormal	2.1	3.0	6.2	3.09	3.07	3.1	3.1

APPENDIX D

BENTHIC COMMUNITY ANALYSIS RESULTS

Appendix D
Benthic Macroinvertebrate Data for Dead Creek Sector F, the Borrow Pit Lake, and Reference Areas
Sauget Area I

Station ID	Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	Number of Organisms Counted	Amount of Sample Analyzed (%)	Sample Total	Relative Abundance (Percent)
F-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	5	50	10	19.23
F-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Einfeldia*	*sp.*	4	50	8	15.38
F-1-1	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	3	50	6	11.54
F-1-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Culicoides*	*sp.*	3	50	6	11.54
F-1-1	Mollusca	Pelecypoda	Prionodesmacea	Sphaeriidae			*Sphaerium*	*sp.*	2	50	4	7.69
F-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*claparedianus*	1	50	2	3.85
F-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Haemonais*	*waldvogeli*	1	50	2	3.85
F-1-1	Arthropoda	Insecta	Lepidoptera	Pyralidae			*Acentria*	*sp.*	1	50	2	3.85
F-1-1	Arthropoda	Insecta	Hemiptera	Pleidae			*Neoplea*	*sp.*	1	50	2	3.85
F-1-1	Arthropoda	Insecta	Coleoptera	Hydrophilidae			*Hydrochus*	*sp.*	1	50	2	3.85
F-1-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	50	2	3.85
F-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*decorus*	1	50	2	3.85
F-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*sp.*	1	50	2	3.85
F-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*carinatus*	1	50	2	3.85
F-1-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*sp.*	17	50	34	56.67
F-1-2	Mollusca	Pelecypoda	Prionodesmacea	Sphaeriidae			*Sphaerium*	*sp.*	8	50	16	26.67
F-1-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	3	50	6	10.00
F-1-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*claparedianus*	1	50	2	3.33
F-1-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	50	2	3.33
F-1-3	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	5	50	10	22.73
F-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Culicoides*	*sp.*	4	50	8	18.18
F-1-3	Mollusca	Pelecypoda	Prionodesmacea	Sphaeriidae			*Musculium*	*sp.*	4	50	8	18.18
F-1-3	Mollusca	Pelecypoda	Prionodesmacea	Sphaeriidae			*Sphaerium*	*sp.*	3	50	6	13.64
F-1-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*sp.*	2	50	4	9.09
F-1-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	2	50	4	9.09
F-1-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	50	2	4.55
F-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	50	2	4.55
F-2-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	7	50	14	38.89
F-2-1	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	5	50	10	27.78
F-2-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	3	50	6	16.67
F-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Coelotanypodini	*Coelotanypus*	*scapularis*	1	50	2	5.56
F-2-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Bezzia*	*sp.*	1	50	2	5.56
F-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*sp.*	1	50	2	5.56
F-2-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	12	50	24	33.33
F-2-2	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	8	50	16	22.22
F-2-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	8	50	16	22.22
F-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*sp.*	2	50	4	5.56
F-2-2	Arthropoda	Insecta	Hemiptera	Pleidae			*Neoplea*	*sp.*	2	50	4	5.56
F-2-2	Arthropoda	Insecta	Hemiptera	Mesoveliidae			*Mesovelia*	*sp.*	1	50	2	2.78
F-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	1	50	2	2.78
F-2-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Culicoides*	*sp.*	1	50	2	2.78
F-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae		*Psectrotanypus*	*sp.*	1	50	2	2.78
F-2-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	11	50	22	47.83
F-2-3	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	9	50	18	39.13
F-2-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	2	50	4	8.70
F-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	1	50	2	4.35
F-3-1	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	28	50	56	53.85
F-3-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	14	50	28	26.92
F-3-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Ilyodrilus*	*templetoni*	3	50	6	5.77
F-3-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae		*Krenopelopia*	*sp.*	2	50	4	3.85
F-3-1	Arthropoda	Insecta	Coleoptera	Dytiscidae			*Hygrotus*	*sp.*	1	50	2	1.92
F-3-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Culicoides*	*sp.*	1	50	2	1.92
F-3-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	1	50	2	1.92
F-3-1	Arthropoda	Insecta	Coleoptera	Hydrophilidae			*Tropisternus*	*sp.*	1	50	2	1.92
F-3-1	Arthropoda	Insecta	Diptera	Stratiomyidae			*Stratiomys*	*sp.*	1	50	2	1.92

Appendix D

Benthic Macroinvertebrate Data for Dead Creek Sector F, the Borrow Pit Lake, and Reference Areas

Sauget Area I

Station ID	Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	Number of Organisms Counted	Amount of Sample Analyzed (%)	Sample Total	Relative Abundance (Percent)
F-3-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	31	50	62	45.59
F-3-2	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	27	50	54	39.71
F-3-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Ilyodrilus*	*templetoni*	2	50	4	2.94
F-3-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	2	50	4	2.94
F-3-2	Mollusca	Gastropoda	Basommatophora	Physidae			*Physella*	*heterostropha*	2	50	4	2.94
F-3-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Dero*	*vaga*	1	50	2	1.47
F-3-2	Arthropoda	Insecta	Hemiptera	Corixidae	Corixinae		*Trichocorixa*	*sp.*	1	50	2	1.47
F-3-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	1	50	2	1.47
F-3-2	Arthropoda	Insecta	Diptera	Tipulidae			*Tipulidae (family)*		1	50	2	1.47
F-3-3	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	26	50	52	44.07
F-3-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	11	50	22	18.64
F-3-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*illinoense*	10	50	20	16.95
F-3-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	3	50	6	5.08
F-3-3	Arthropoda	Insecta	Diptera				*Diptera (class)*		3	50	6	5.08
F-3-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae		*Krenopelopia*	*sp.*	3	50	6	5.08
F-3-3	Arthropoda	Insecta	Diptera	Tipulidae			*Limonia*	*sp.*	1	50	2	1.69
F-3-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	50	2	1.69
F-3-3	Mollusca	Gastropoda	Basommatophora	Physidae			*Physella*	*heterostropha*	1	50	2	1.69
BP-1-1	Arthropoda	Insecta	Odonata	Libellulidae			*Perithemis*	*sp.*	5	50	10	29.41
BP-1-1	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	3	50	6	17.65
BP-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	3	50	6	17.65
BP-1-1	Arthropoda	Insecta	Hemiptera	Corixidae			*Palmacorixa*	*sp.*	2	50	4	11.76
BP-1-1	Annelida	Hirudinea	Pharyngobdellida	Erpobdellidae			*Mooreobdella*	*microstoma*	1	50	2	5.88
BP-1-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	50	2	5.88
BP-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Natarsiini	*Natarsia*	*sp.*	1	50	2	5.88
BP-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	50	2	5.88
BP-1-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	4	50	8	17.39
BP-1-2	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	3	50	6	13.04
BP-1-2	Arthropoda	Insecta	Hemiptera	Corixidae			*Palmacorixa*	*sp.*	3	50	6	13.04
BP-1-2	Annelida	Hirudinea	Pharyngobdellida	Erpobdellidae			*Mooreobdella*	*microstoma*	2	50	4	8.70
BP-1-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	2	50	4	8.70
BP-1-2	Arthropoda	Insecta	Ephemeroptera	Caenidae			*Caenis*	*sp.*	2	50	4	8.70
BP-1-2	Arthropoda	Insecta	Odonata	Libellulidae			*Perithemis*	*sp.*	2	50	4	8.70
BP-1-2	Annelida	Oligochaeta	Tubificida	Naididae			*Aulodrilus*	*pigueti*	1	50	2	4.35
BP-1-2	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	1	50	2	4.35
BP-1-2	Arthropoda	Insecta	Trichoptera	Hydroptilidae	Hydroptilinae		*Hydroptila*	*ajax*	1	50	2	4.35
BP-1-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Cryptotendipes*	*sp.*	1	50	2	4.35
BP-1-2	Arthropoda	Insecta	Odonata	Gomphidae			*Arigomphus*	*sp.*	1	50	2	4.35
BP-1-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	7	50	14	30.43
BP-1-3	Arthropoda	Insecta	Hemiptera	Corixidae	Corixinae		*Trichocorixa*	*sp.*	5	50	10	21.74
BP-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	2	50	4	8.70
BP-1-3	Arthropoda	Insecta	Odonata	Libellulidae			*Perithemis*	*sp.*	2	50	4	8.70
BP-1-3	Annelida	Hirudinea	Pharyngobdellida	Erpobdellidae			*Mooreobdella*	*microstoma*	1	50	2	4.35
BP-1-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Ilyodrilus*	*templetoni*	1	50	2	4.35
BP-1-3	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	1	50	2	4.35
BP-1-3	Arthropoda	Insecta	Ephemeroptera	Caenidae			*Caenis*	*sp.*	1	50	2	4.35
BP-1-3	Arthropoda	Insecta	Coleoptera	Hydrophilidae			*Berosus*	*sp.*	1	50	2	4.35
BP-1-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	50	2	4.35
BP-1-3	Nematoda		Dorylaimida				*Alaimus*	*sp.*	1	50	2	4.35
BP-2-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	27	50	54	47.37
BP-2-1	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	6	50	12	10.53
BP-2-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Ilyodrilus*	*templetoni*	5	50	10	8.77
BP-2-1	Annelida	Oligochaeta	Tubificida	Naididae			*Aulodrilus*	*pigueti*	4	50	8	7.02
BP-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*stellatus*	3	50	6	5.26
BP-2-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	3	50	6	5.26
BP-2-1	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	2	50	4	3.51
BP-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Coelotanypodini	*Clinotanypus*	*sp.*	2	50	4	3.51
BP-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	2	50	4	3.51
BP-2-1	Arthropoda	Insecta	Odonata	Gomphidae			*Arigomphus*	*sp.*	1	50	2	1.75
BP-2-1	[illegible]hropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*salinarius*	1	50	2	1.75
BP-2-1	[illegible]poda	Insecta	Diptera	Ceratopogonidae			*Culicoides*	*sp.*	1	50	2	1.75

Appendix D
Benthic Macroinvertebrate Data for Dead Creek Sector F, the Borrow Pit Lake, and Reference Areas
Sauget Area I

Station ID	Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	Number of Organisms Counted	Amount of Sample Analyzed (%)	Sample Total	Relative Abundance (Percent)
BP-2-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	13	50	26	44.83
BP-2-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Ilyodrilus*	*templetoni*	4	50	8	13.79
BP-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*salinarius*	3	50	6	10.34
BP-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Procladiini	*Procladius*	*sp.*	3	50	6	10.34
BP-2-2	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	2	50	4	6.90
BP-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Coelotanypodini	*Clinotanypus*	*sp.*	2	50	4	6.90
BP-2-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	50	2	3.45
BP-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	50	2	3.45
BP-2-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	18	50	36	40.00
BP-2-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	7	50	14	15.56
BP-2-3	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	6	50	12	13.33
BP-2-3	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	2	50	4	4.44
BP-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*decorus*	2	50	4	4.44
BP-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	*Tanytarsus*	*sp.*	2	50	4	4.44
BP-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*stellatus*	2	50	4	4.44
BP-2-3	Arthropoda	Insecta	Odonata	Gomphidae			*Arigomphus*	*sp.*	1	50	2	2.22
BP-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Cladopelma*	*sp.*	1	50	2	2.22
BP-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Coelotanypodini	*Clinotanypus*	*sp.*	1	50	2	2.22
BP-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Procladiini	*Procladius*	*sp.*	1	50	2	2.22
BP-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	50	2	2.22
BP-2-3	Arthropoda	Insecta	Diptera	Tipulidae			*Tipulidae (family)*		1	50	2	2.22
BP-3-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	42	100	42	50.00
BP-3-1	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	16	100	16	19.05
BP-3-1	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	9	100	9	10.71
BP-3-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	5	100	5	5.95
BP-3-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	4	100	4	4.76
BP-3-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Cryptochironomus*	*fulvus*	3	100	3	3.57
BP-3-1	Arthropoda	Insecta	Odonata	Libellulidae			*Perithemis*	*sp.*	2	100	2	2.38
BP-3-1	Annelida	Oligochaeta	Tubificida	Naididae			*Aulodrilus*	*pigueti*	1	100	1	1.19
BP-3-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Coelotanypodini	*Clinotanypus*	*sp.*	1	100	1	1.19
BP-3-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	1	100	1	1.19
BP-3-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	7	100	7	43.75
BP-3-2	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	2	100	2	12.50
BP-3-2	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	1	100	1	6.25
BP-3-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	100	1	6.25
BP-3-2	Arthropoda	Insecta	Odonata	Libellulidae			*Plathemis*	*sp.*	1	100	1	6.25
BP-3-2	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	*Tanytarsus*	*sp.*	1	100	1	6.25
BP-3-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	100	1	6.25
BP-3-2	Arthropoda	Insecta	Odonata	Libellulidae			*Perithemis*	*sp.*	1	100	1	6.25
BP-3-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	1	100	1	6.25
BP-3-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	36	100	36	70.59
BP-3-3	Annelida	Oligochaeta	Tubificida	Naididae			*Branchiura*	*sowerbyi*	5	100	5	9.80
BP-3-3	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	3	100	3	5.88
BP-3-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	2	100	2	3.92
BP-3-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Bezzia*	*sp.*	1	100	1	1.96
BP-3-3	Arthropoda	Insecta	Diptera	Chaoboridae			*Chaoborus*	*punctipennis*	1	100	1	1.96
BP-3-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Cryptochironomus*	*fulvus*	1	100	1	1.96
BP-3-3	Arthropoda	Insecta	Odonata	Libellulidae			*Perithemis*	*sp.*	1	100	1	1.96
BP-3-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	100	1	1.96
PDC-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	71	100	71	89.87
PDC-1-1	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	2	100	2	2.53
PDC-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Ilyodrilus*	*templetoni*	2	100	2	2.53
PDC-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Psammoryctides*	*californianus*	2	100	2	2.53
PDC-1-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	100	1	1.27
PDC-1-1	Arthropoda	Insecta	Diptera	Chaoboridae			*Chaoborus*	*punctipennis*	1	100	1	1.27
PDC-1-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	4	100	4	66.67
PDC-1-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	100	1	16.67
PDC-1-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Bezzia*	*sp.*	1	100	1	16.67
PDC-1-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	4	100	4	57.14
PDC-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	2	100	2	28.57
PDC-1-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	100	1	14.29

Appendix D
Benthic Macroinvertebrate Data for Dead Creek Sector F, the Borrow Pit Lake, and Reference Areas
Sauget Area I

Station ID	Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	Number of Organisms Counted	Amount of Sample Analyzed (%)	Sample Total	Relative Abundance (Percent)
PDC-2-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	3	100	3	75.00
PDC-2-1	Mollusca	Pelecypoda	Prionodesmacea	Unionidae			*Lampsilis*	*sp.*	1	100	1	25.00
PDC-2-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	30	100	30	83.33
PDC-2-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Ilyodrilus*	*templetoni*	3	100	3	8.33
PDC-2-2	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	1	100	1	2.78
PDC-2-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Psammoryctides*	*californianus*	1	100	1	2.78
PDC-2-2	Arthropoda	Crustacea	Decapoda	Palaemonidae			*Palaemonetes*	*kadiakensis*	1	100	1	2.78
PDC-2-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	49	50	98	90.74
PDC-2-3	Arthropoda	Insecta	Diptera	Chaoboridae			*Chaoborus*	*punctipennis*	2	50	4	3.70
PDC-2-3	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	1	50	2	1.85
PDC-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*decorus*	1	50	2	1.85
PDC-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Procladiini	*Procladius*	*sp.*	1	50	2	1.85
REF2-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	149	10	1490	90.85
REF2-1-1	Arthropoda	Insecta	Diptera	Ephydridae			*Ephydra*	*subopaca*	6	10	60	3.66
REF2-1-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	2	10	20	1.22
REF2-1-1	Arthropoda	Crustacea	Decapoda	Palaemonidae			*Palaemonetes*	*kadiakensis*	2	10	20	1.22
REF2-1-1	Mollusca	Gastropoda	Basommatophora	Physidae			*Physella*	*heterostropha*	2	10	20	1.22
REF2-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Nais*	*variabilis*	1	10	10	0.61
REF2-1-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*udekemianus*	1	10	10	0.61
REF2-1-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	1	10	10	0.61
REF2-1-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	115	10	1150	89.15
REF2-1-2	Mollusca	Gastropoda	Basommatophora	Physidae			*Physella*	*heterostropha*	3	10	30	2.33
REF2-1-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	2	10	20	1.55
REF2-1-2	Arthropoda	Insecta	Hemiptera	Corixidae	Corixinae		*Trichocorixa*	*sp.*	2	10	20	1.55
REF2-1-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	2	10	20	1.55
REF2-1-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Psammoryctides*	*californianus*	1	10	10	0.78
REF2-1-2	Annelida	Oligochaeta	Tubificida	Naididae			*Aulodrilus*	*pluriseta*	1	10	10	0.78
REF2-1-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	1	10	10	0.78
REF2-1-2	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Culicoides*	*sp.*	1	10	10	0.78
REF2-1-2	Arthropoda	Insecta	Hemiptera	Corixidae			*Sigara*	*sp.*	1	10	10	0.78
REF2-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Culicoides*	*sp.*	60	10	600	40.27
REF2-1-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	50	10	500	33.56
REF2-1-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	28	10	280	18.79
REF2-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	5	10	50	3.36
REF2-1-3	Annelida	Oligochaeta	Tubificida	Naididae			*Aulodrilus*	*pluriseta*	2	10	20	1.34
REF2-1-3	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	1	10	10	0.67
REF2-1-3	Arthropoda	Insecta	Hemiptera	Corixidae	Corixinae		*Trichocorixa*	*sp.*	1	10	10	0.67
REF2-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Bezzia*	*sp.*	1	10	10	0.67
REF2-1-3	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	1	10	10	0.67
REF2-2-1	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	22	100	22	59.46
REF2-2-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon*	*sp.*	8	100	8	21.62
REF2-2-1	Annelida	Oligochaeta	Tubificida	Naididae			*Dero*	*digitata*	1	100	1	2.70
REF2-2-1	Annelida	Oligochaeta	Tubificida	Naididae			*Aulodrilus*	*pigueti*	1	100	1	2.70
REF2-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	100	1	2.70
REF2-2-1	Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias*	*sp.*	1	100	1	2.70
REF2-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	*Tanytarsus*	*sp.*	1	100	1	2.70
REF2-2-1	Arthropoda	Insecta	Diptera	Tipulidae			*Ormosia*	*sp.*	1	100	1	2.70
REF2-2-1	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae	Orthocladiini	*Psectrocladius*	*sp.*	1	100	1	2.70
REF2-2-2	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	13	100	13	92.86
REF2-2-2	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	*Ablabesmyia*	*annulata*	1	100	1	7.14
REF2-2-3	Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus*	*hoffmeisteri*	25	100	25	69.44
REF2-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus*	*salinarius*	8	100	8	22.22
REF2-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Polypedilum*	*scalaenum*	1	100	1	2.78
REF2-2-3	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Tanypodini	*Tanypus*	*neopunctipennis*	1	100	1	2.78
REF2-2-3	Arthropoda	Insecta	Hemiptera	Corixidae	Corixinae		*Trichocorixa*	*sp.*	1	100	1	2.78

Ecology | Environmental Toxicology | Natural Resource Assessments | Microbiology

Charlie Menzie
Menzie-Cura & Associates
1 Courthouse Lane
Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 13012
Client Sample ID : F-1-1-"CREEK SECTOR F-1"
Remarks :

Date/Time Sample Collected : 10/7/99 @ 3:00:00 P
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Haemonais waldvogeli*	1
			Tubificidae			*Branchiura sowerbyi*	3
						Limnodrilus claparedianus	1
usca	Pelecypoda	Prionodesmacea	Sphaeriidae			*Sphaerium sp.*	2
Arthropoda	Insecta	Coleoptera	Hydrophilidae			*Hydrochus sp.*	1
		Diptera	Ceratopogonidae			*Ceratopogon sp.*	1
						Culicoides sp.	3
			Chironomidae	Chironominae	Chironomini	*Chironomus sp.*	1
						Chironomus decorus	1
						Einfeldia sp.	4
						Polypedilum illinoense	5
				Tanypodinae	Tanypodini	*Tanypus carinatus*	1
		Hemiptera	Pleidae			*Neoplea sp.*	1
		Lepidoptera	Pyralidae			*Acentria sp*	1
						Sub-Total:	**26**
						Grand Total:	**26**

75 Green Mountain Drive, South Burlington, Vt. 05403 Tel: 802.860.1638 Fax: 802.658.3189

Aquatec Biological Sciences

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Charlie Menzie		**Date**	**: 12/23/99**
Menzie-Cura & Associates		**BTR No.**	**: 03703**
1 Courthouse Lane		**Project No.**	**: 99033**
Chelmsford, MA 01824		**No. of Samples**	**: 69**
		Date Received	**: 10/26/99**

Reference: SAUGET,IL

Laboratory Sample ID	: 13013	**Date/Time Sample Collected**	: 10/7/99 @ 3:00:00 P
Client Sample ID	: F-1-2-"CREEK SECTOR F-1"	**Percent Sample Examined**	: 50
Remarks	:	**Sampling Depth (m)**	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus claparedianus*	1
Mollusca	Pelecypoda	Prionodesmacea	Sphaeriidae			*Sphaerium sp.*	8
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	1
			Chironomidae	Chironominae	Chironomini	*Chironomus sp.*	
						Polypedilum illinoense	3
						Sub-Total:	30
						Grand Total:	30

75 Green Mountain Drive, South Burlington, Vt. 05403 Tel: 802.860.1638 Fax: 802.658.3189

Charlie Menzie
Menzie-Cura & Associates
1 Courthouse Lane
Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 13014
Client Sample ID : F-1-3-"CREEK SECTOR F-1"
Remarks :

Date/Time Sample Collected : 10/7/99 @ 3:00:00 P
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	5
Mollusca	Pelecypoda	Prionodesmacea	Sphaeriidae			*Musculium sp.*	4
						Sphaerium sp.	3
.ropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	1
						Culicoides sp.	4
			Chironomidae	Chironominae	Chironomini	*Chironomus sp.*	2
						Polypedilum illinoense	2
				Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	1
						Sub-Total:	22
						Grand Total:	22

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1 Courthouse Lane
Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 13015
Client Sample ID : F-2-1-"CREEK SECTOR F-2"
Remarks :

Date/Time Sample Collected : 10/7/99 @ 4:10:00 P
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	5
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Bezzia sp.*	1
						Ceratopogon sp.	3
						Sphaeromias sp.	
			Chironomidae	Chironominae	Chironomini	*Chironomus sp.*	7
				Tanypodinae	Coelotanypodini	*Coelotanypus scapularis*	1
						Sub-Total:	18
						Grand Total:	18

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Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 13016
Client Sample ID : F-2-2-"CREEK SECTOR F-2"
Remarks :

Date/Time Sample Collected : 10/7/99 @ 4:10:00 P
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	8
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	12
						Culicoides sp.	1
						Sphaeromias sp	8
			Chironomidae	Chironominae	Chironomini	*Chironomus sp.*	2
						Polypedilum illinoense	1
				Tanypodinae		*Psectrotanypus sp.*	1
		Hemiptera	Mesoveliidae			*Mesovelia sp.*	1
			Pleidae			*Neoplea sp.*	2
						Sub-Total:	36
						Grand Total:	36

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Charlie Menzie	**Date** : 12/23/99
Menzie-Cura & Associates	**BTR No.** : 03703
1 Courthouse Lane	**Project No.** : 99033
Chelmsford, MA 01824	**No. of Samples** : 69
	Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 13017	Date/Time Sample Collected : 10/7/99 @ 4:10:00 P
Client Sample ID : F-2-3-"CREEK SECTOR F-2"	Percent Sample Examined : 50
Remarks :	Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	9
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	11
						Sphaeromias sp.	2
			Chironomidae	Chironominae	Chironomini	*Polypedilum illinoense*	
						Sub-Total:	23
						Grand Total:	23

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Charlie Menzie		Date	: 12/23/99
Menzie-Cura & Associates		BTR No.	: 03703
1 Courthouse Lane		Project No.	: 99033
Chelmsford, MA 01824		No. of Samples	: 69
		Date Received	: 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 13018	Date/Time Sample Collected	: 10/7/99 @ 10:45:00
Client Sample ID	: *F-3-1-"CREEK SECTOR F-3"*	Percent Sample Examined	: 50
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	28
						Ilyodrilus templetoni	3
						Limnodrilus hoffmeisteri	14
ıropoda	Insecta	Coleoptera	Dytiscidae			*Hygrotus sp.*	1
			Hydrophilidae			*Tropisternus sp*	1
		Diptera	Ceratopogonidae			*Culicoides sp.*	1
			Chironomidae	Chironominae	Chironomini	*Polypedilum illinoense*	1
				Tanypodinae		*Krenopelopia sp.*	2
			Stratiomyidae			*Stratiomys sp.*	1
						Sub-Total:	52
						Grand Total:	52

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Date	**: 12/23/99**
BTR No.	**: 03703**
Project No.	**: 99033**
No. of Samples	**: 69**
Date Received	**: 10/26/99**

Reference: SAUGET,IL

Laboratory Sample ID	: 13019	**Date/Time Sample Collected**	: 10/7/99 @ 10:45:00
Client Sample ID	: F-3-2-"CREEK SECTOR F-3"	**Percent Sample Examined**	: 50
Remarks	:	**Sampling Depth (m)**	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero vaga*	1
			Tubificidae			*Branchiura sowerbyi*	27
						Ilyodrilus templetoni	2
						Limnodrilus hoffmeisteri	[illegible]
Mollusca	Gastropoda	Basommatophora	Physidae			*Physella heterostropha*	2
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Sphaeromias sp.*	1
			Chironomidae	Chironominae	Chironomini	*Polypedilum illinoense*	2
			Tipulidae				1
		Hemiptera	Corixidae	Corixinae		*Trichocorixa sp.*	1
						Sub-Total:	**68**
						Grand Total:	**68**

Submitted By: Philip C Downey

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Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12965
Client Sample ID : F-3-3-"CREEK SECTOR F-3"
Remarks :

Date/Time Sample Collected : 10/7/99 @ 10:45:00
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	26
						Limnodrilus hoffmeisteri	11
Mollusca	Gastropoda	Basommatophora	Physidae			*Physella heterostropha*	1
ropoda	Insecta	Diptera					3
			Ceratopogonidae			*Ceratopogon sp.*	1
						Sphaeromias sp.	3
			Chironomidae	Chironominae	Chironomini	*Polypedilum illinoense*	10
				Tanypodinae		*Krenopelopia sp.*	3
			Tipulidae			*Limonia sp.*	1
						Sub-Total:	59
						Grand Total:	59

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Chelmsford, MA 01824		No. of Samples	: 69
		Date Received	: 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12985	Date/Time Sample Collected	: 10/6/99 @ 11:30:00
Client Sample ID	: BP-1-1-"BORROW PIT LAKE-1"	Percent Sample Examined	: 50
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Hirudinea	Pharyngobdellida	Erpobdellidae			*Mooreobdella microstoma*	1
	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	3
						Limnodrilus hoffmeisteri	3
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	'
			Chironomidae	Tanypodinae	Natarsiini	*Natarsia sp.*	1
					Tanypodini	*Tanypus neopunctipennis*	1
		Hemiptera	Corixidae			*Palmacorixa sp.*	2
		Odonata	Libellulidae			*Perithemis sp.*	5
						Sub-Total:	17
						Grand Total:	17

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Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12986
Client Sample ID : BP-1-2-"BORROW PIT LAKE -1"
Remarks :

Date/Time Sample Collected : 10/6/99 @ 11:30:00
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Hirudinea	Pharyngobdellida	Erpobdellidae			*Mooreobdella microstoma*	2
	Oligochaeta	Tubificida	Naididae			*Dero digitata*	3
			Tubificidae			*Aulodrilus pigueti*	1
						Branchiura sowerbyi	1
						Limnodrilus hoffmeisteri	4
Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Cryptotendipes sp.*	1
				Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	2
		Ephemeroptera	Caenidae			*Caenis sp.*	2
		Hemiptera	Corixidae			*Palmacorixa sp.*	3
		Odonata	Gomphidae			*Arigomphus sp.*	1
			Libellulidae			*Perithemis sp.*	2
		Trichoptera	Hydroptilidae	Hydroptilinae		*Hydroptila ajax*	1
						Sub-Total:	23
						Grand Total:	23

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Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12987
Client Sample ID : BP-1-3-"BORROW PIT LAKE-1"
Remarks :

Date/Time Sample Collected : 10/6/99 @ 11:30:00
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Nematoda		Dorylaimida				*Alaimus sp.*	1
Annelida	Hirudinea	Pharyngobdellida	Erpobdellidae			*Mooreobdella microstoma*	1
	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	1
						Ilyodrilus templetoni	1
						Limnodrilus hoffmeisteri	[illegible]
Arthropoda	Insecta	Coleoptera	Hydrophilidae			*Berosus sp.*	1
		Diptera	Ceratopogonidae			*Ceratopogon sp.*	2
			Chironomidae	Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	1
		Ephemeroptera	Caenidae			*Caenis sp.*	1
		Hemiptera	Corixidae	Corixinae		*Trichocorixa sp.*	5
		Odonata	Libellulidae			*Perithemis sp.*	2
						Sub-Total:	23
						Grand Total:	23

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Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12995
Client Sample ID : BP-2-1-"BORROW PIT LAKE-2"
Remarks :

Date/Time Sample Collected : 10/6/99 @ 9:30:00 A
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	6
			Tubificidae			*Aulodrilus pigueti*	4
						Branchiura sowerbyi	2
						Ilyodrilus templetoni	5
						Limnodrilus hoffmeisteri	27
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	3
						Culicoides sp.	1
			Chironomidae	Chironominae	Chironomini	*Chironomus salinarius*	1
				Tanypodinae	Coelotanypodini	*Clinotanypus sp.*	2
					Tanypodini	*Tanypus neopunctipennis*	2
						Tanypus stellatus	3
		Odonata	Gomphidae			*Arigomphus sp.*	1
						Sub-Total:	57
						Grand Total:	57

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Date	: 12/23/99
BTR No.	: 03703
Project No.	: 99033
No. of Samples	: 69
Date Received	: 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12988	Date/Time Sample Collected	: 10/6/99 @ 9:30:00 A
Client Sample ID	: BP-2-2-"BORROW PIT LAKE-2"	Percent Sample Examined	: 50
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Branchiura sowerbyi*	2
						Ilyodrilus templetoni	4
						Limnodrilus hoffmeisteri	13
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	
			Chironomidae	Chironominae	Chironomini	*Chironomus salinarius*	3
				Tanypodinae	Coelotanypodini	*Clinotanypus sp.*	2
					Procladiini	*Procladius sp.*	3
					Tanypodini	*Tanypus neopunctipennis*	1
						Sub-Total:	**29**
						Grand Total:	**29**

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Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12989
Client Sample ID : BP-2-3-"BORROW PIT LAKE-2"
Remarks :

Date/Time Sample Collected : 10/6/99 @ 9:30:00 A
Percent Sample Examined : 50
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	6
			Tubificidae			*Branchiura sowerbyi*	2
						Limnodrilus hoffmeisteri	18
ropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	7
			Chironomidae	Chironominae	Chironomini	*Chironomus decorus*	2
						Cladopelma sp.	1
					Tanytarsini	*Tanytarsus sp.*	2
				Tanypodinae	Coelotanypodini	*Clinotanypus sp.*	1
					Procladiini	*Procladius sp.*	1
					Tanypodini	*Tanypus neopunctipennis*	1
						Tanypus stellatus	2
			Tipulidae				1
		Odonata	Gomphidae			*Arigomphus sp.*	1
						Sub-Total:	**45**
						Grand Total:	**45**

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Menzie-Cura & Associates		**BTR No.**	**: 03703**
1 Courthouse Lane		**Project No.**	**: 99033**
Chelmsford, MA 01824		**No. of Samples**	**: 69**
		Date Received	**: 10/26/99**

Reference: SAUGET,IL

Laboratory Sample ID	: 12992	**Date/Time Sample Collected**	: 10/6/99 @ 4:30:00 P
Client Sample ID	: BP-3-1-"BORROW PIT LAKE-3"	**Percent Sample Examined**	: 100
Remarks	:	**Sampling Depth (m)**	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	16
			Tubificidae			*Aulodrilus pigueti*	1
						Branchiura sowerbyi	9
						Limnodrilus hoffmeisteri	[illegible]
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	[illegible]
						Sphaeromias sp.	1
			Chironomidae	Chironominae	Chironomini	*Cryptochironomus fulvus*	3
				Tanypodinae	Coelotanypodini	*Clinotanypus sp.*	1
					Tanypodini	*Tanypus neopunctipennis*	4
		Odonata	Libellulidae			*Perithemis sp.*	2
						Sub-Total:	**84**
						Grand Total:	**84**

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Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12990
Client Sample ID : BP-3-2-"BORROW PIT LAKE-3"
Remarks :

Date/Time Sample Collected : 10/6/99 @ 4:30:00 P
Percent Sample Examined : 100
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	1
			Tubificidae			*Branchiura sowerbyi*	2
						Limnodrilus hoffmeisteri	7
ıropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	1
						Sphaeromias sp	1
			Chironomidae	Chironominae	Tanytarsini	*Tanytarsus sp.*	1
				Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	1
		Odonata	Libellulidae			*Perithemis sp.*	1
						Plathemis sp.	1
						Sub-Total:	16
						Grand Total:	16

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Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12991	Date/Time Sample Collected	: 10/6/99 @ 4:30:00 P
Client Sample ID	: BP-3-3-"BORROW PIT LAKE-3"	Percent Sample Examined	: 100
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	3
			Tubificidae			*Branchiura sowerbyi*	5
						Limnodrilus hoffmeisteri	36
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Bezzia sp.*	
						Ceratopogon sp.	2
			Chaoboridae			*Chaoborus punctipennis*	1
			Chironomidae	Chironominae	Chironomini	*Cryptochironomus fulvus*	1
				Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	1
		Odonata	Libellulidae			*Perithemis sp.*	1
						Sub-Total:	51
						Grand Total:	51

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Chelmsford, MA 01824		No. of Samples	: 69
		Date Received	: 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12979	Date/Time Sample Collected	: 10/8/99 @ 9:30:00 A
Client Sample ID	: PDC-1-1-"PRARIE DUPONT CREEK-1"	Percent Sample Examined	: 100
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	2
			Tubificidae			*Ilyodrilus templetoni*	2
						Limnodrilus hoffmeisteri	71
						Psammoryctides californianus	2
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	1
			Chaoboridae			*Chaoborus punctipennis*	1
						Sub-Total:	79
						Grand Total:	79

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1 Courthouse Lane
Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12980
Client Sample ID : PDC-1-2-"PRARIE DUPONT CREEK-1"
Remarks :

Date/Time Sample Collected : 10/8/99 @ 9:30:00 A
Percent Sample Examined : 100
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus hoffmeisteri*	4
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Bezzia sp.*	1
						Ceratopogon sp.	1
						Sub-Total:	6
						Grand Total:	[illegible]

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Charlie Menzie
Menzie-Cura & Associates
1 Courthouse Lane
Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12981
Client Sample ID : PDC-1-3-"PRARIE DUPONT CREEK-1"
Remarks :

Date/Time Sample Collected : 10/8/99 @ 9:30:00 A
Percent Sample Examined : 100
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus hoffmeisteri*	4
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	2
			Chironomidae	Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	1
						Sub-Total:	7
						Grand Total:	7

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Charlie Menzie		**Date**	**: 12/23/99**
Menzie-Cura & Associates		**BTR No.**	**: 03703**
1 Courthouse Lane		**Project No.**	**: 99033**
Chelmsford, MA 01824		**No. of Samples**	**: 69**
		Date Received	**: 10/26/99**

Reference: SAUGET,IL

Laboratory Sample ID	: 12982	Date/Time Sample Collected	: 10/8/99 @ 11:20:00
Client Sample ID	: PDC-2-1-"PRARIE DUPONT CREEK-2"	Percent Sample Examined	: 100
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus hoffmeisteri*	3
Mollusca	Pelecypoda	Prionodesmacea	Unionidae			*Lampsilis sp.*	1
						Sub-Total:	**4**
						Grand Total:	**4**

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Charlie Menzie		Date	: 12/23/99
Menzie-Cura & Associates		BTR No.	: 03703
1 Courthouse Lane		Project No.	: 99033
Chelmsford, MA 01824		No. of Samples	: 69
		Date Received	: 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12983	Date/Time Sample Collected	: 10/8/99 @ 11:20:00
Client Sample ID	: PDC-2-2-"PRARIE DUPONT CREEK-2"	Percent Sample Examined	: 100
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	1
			Tubificidae			*Ilyodrilus templetoni*	3
						Limnodrilus hoffmeisteri	30
						Psammoryctides californianus	1
Arthropoda	Crustacea	Decapoda	Palaemonidae			*Palaemonetes kadiakensis*	1
						Sub-Total:	36
						Grand Total:	36

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Charlie Menzie		**Date**	**: 12/23/99**
Menzie-Cura & Associates		**BTR No.**	**: 03703**
1 Courthouse Lane		**Project No.**	**: 99033**
Chelmsford, MA 01824		**No. of Samples**	**: 69**
		Date Received	**: 10/26/99**

Reference: SAUGET,IL

Laboratory Sample ID	**: 12984**	**Date/Time Sample Collected**	**: 10/8/99 @ 11:20:00**
Client Sample ID	**: PDC-2-3-"PRARIE DUPONT CREEK-2"**	**Percent Sample Examined**	**: 50**
Remarks	**:**	**Sampling Depth (m)**	**: Not Reported**

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	1
			Tubificidae			*Limnodrilus hoffmeisteri*	49
Arthropoda	Insecta	Diptera	Chaoboridae			*Chaoborus punctipennis*	2
			Chironomidae	Chironominae	Chironomini	*Chironomus decorus*	1
				Tanypodinae	Procladiini	*Procladius sp.*	1
						Sub-Total:	**54**
						Grand Total:	**54**

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Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID : 12973
Client Sample ID : REF2-1-1-"REFERENCE LOCATION 2-1"
Remarks :

Date/Time Sample Collected : 10/8/99 @ 2:30:00 P
Percent Sample Examined : 10
Sampling Depth (m) : Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Nais variabilis*	1
			Tubificidae			*Limnodrilus hoffmeisteri*	149
						Limnodrilus udekemianus	1
ısca	Gastropoda	Basommatophora	Physidae			*Physella heterostropha*	2
Arthropoda	Crustacea	Decapoda	Palaemonidae			*Palaemonetes kadiakensis*	2
	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	1
			Chironomidae	Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	2
			Ephydridae			*Ephydra subopaca*	6
						Sub-Total:	**164**
						Grand Total:	**164**

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1 Courthouse Lane
Chelmsford, MA 01824

Date : 12/23/99
BTR No. : 03703
Project No. : 99033
No. of Samples : 69
Date Received : 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12974	Date/Time Sample Collected	: 10/8/99 @ 2:30:00 P
Client Sample ID	: REF2-1-2-"REFERENCE LOCATION 2-1"	Percent Sample Examined	: 10
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Aulodrilus pluriseta*	1
						Limnodrilus hoffmeisteri	115
						Psammoryctides californianus	1
Mollusca	Gastropoda	Basommatophora	Physidae			*Physella heterostropha*	[illegible]
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	2
						Culicoides sp.	1
						Sphaeromias sp.	1
			Chironomidae	Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	2
		Hemiptera	Corixidae			*Sigara sp.*	1
				Corixinae		*Trichocorixa sp.*	2
						Sub-Total:	129
						Grand Total:	129

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Charlie Menzie		Date	: 12/23/99
Menzie-Cura & Associates		BTR No.	: 03703
1 Courthouse Lane		Project No.	: 99033
Chelmsford, MA 01824		No. of Samples	: 69
		Date Received	: 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12975	Date/Time Sample Collected	: 10/8/99 @ 2:30:00 P
Client Sample ID	: REF2-1-3-"REFERENCE LOCATION 2-1"	Percent Sample Examined	: 10
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	1
			Tubificidae			*Aulodrilus pluriseta*	2
						Limnodrilus hoffmeisteri	50
ɔpoda	Insecta	Diptera	Ceratopogonidae			*Bezzia sp.*	1
						Ceratopogon sp.	5
						Culicoides sp.	60
						Sphaeromias sp.	1
			Chironomidae	Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	28
		Hemiptera	Corixidae	Corixinae		*Trichocorixa sp.*	1
						Sub-Total:	**149**
						Grand Total:	**149**

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Charlie Menzie		Date	: 12/23/99
Menzie-Cura & Associates		BTR No.	: 03703
1 Courthouse Lane		Project No.	: 99033
Chelmsford, MA 01824		No. of Samples	: 69
		Date Received	: 10/26/99

Reference: SAUGET,IL

Laboratory Sample ID	: 12976	**Date/Time Sample Collected**	: 10/9/99 @ 10:30:00
Client Sample ID	: REF2-2-1-"REFERENCE LOCATION 2-2"	**Percent Sample Examined**	: 100
Remarks	:	**Sampling Depth (m)**	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Naididae			*Dero digitata*	1
			Tubificidae			*Aulodrilus pigueti*	1
						Limnodrilus hoffmeisten	22
Arthropoda	Insecta	Diptera	Ceratopogonidae			*Ceratopogon sp.*	8
						Sphaeromias sp.	1
			Chironomidae	Chironominae	Tanytarsini	*Tanytarsus sp.*	1
				Orthocladiinae	Orthocladiini	*Psectrocladius sp.*	1
				Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	1
			Tipulidae			*Ormosia sp.*	1
						Sub-Total:	37
						Grand Total:	37

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Charlie Menzie
Menzie-Cura & Associates
1 Courthouse Lane
Chelmsford, MA 01824

Reference: SAUGET,IL

Date	: 12/23/99
BTR No.	: 03703
Project No.	: 99033
No. of Samples	: 69
Date Received	: 10/26/99

Laboratory Sample ID	: 12977	Date/Time Sample Collected	: 10/9/99 @ 10:30:00
Client Sample ID	: REF-2-2-"REFERENCE LOCATION 2-2"	Percent Sample Examined	: 100
Remarks	:	Sampling Depth (m)	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus hoffmeisteri*	13
Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	*Ablabesmyia annulata*	1
						Sub-Total:	14
						Grand Total:	14

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1 Courthouse Lane
Chelmsford, MA 01824

Reference: SAUGET,IL

Date	: 12/23/99
BTR No.	: 03703
Project No.	: 99033
No. of Samples	: 69
Date Received	: 10/26/99

Laboratory Sample ID	: 12978	**Date/Time Sample Collected**	: 10/9/99 @ 10:30:00
Client Sample ID	: REF-2-3-"REFERENCE LOCATION 2-2"	**Percent Sample Examined**	: 100
Remarks	:	**Sampling Depth (m)**	: Not Reported

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus/Species/Variety	# Counted
Annelida	Oligochaeta	Tubificida	Tubificidae			*Limnodrilus hoffmeisteri*	25
Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	*Chironomus salinarius*	8
						Polypedilum scalaenum	1
				Tanypodinae	Tanypodini	*Tanypus neopunctipennis*	
		Hemiptera	Corixidae	Corixinae		*Trichocorixa sp.*	
						Sub-Total:	**36**
						Grand Total:	**36**

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APPENDIX E

SUMMARY OF SEDIMENT TOXICITY TESTING RESULTS

Results of
Hyalella azteca Survival and Growth
Sediment Toxicity Tests
Conducted on Sediment Samples from
Dead Creek / Sauget, Illinois

Reference BTRs 3615, 3622, 3629, 3633, 3641, 3643

Prepared for:
Menzie-Cura & Associates
1 Courthouse Lane, Suite 2
Chelmsford, MA 01824

Aquatec Biological Sciences

Prepared by:
Aquatec Biological Sciences
75 Green Mountain Drive
South Burlington, Vermont

December 1999

EXECUTIVE SUMMARY

100.1HASG Amphipod, *Hyalella azteca* 10 Day Survival and Growth Test
Conducted October 7 - October 31, 1999
for Menzie-Cura & Associates
Dead Creek Site

Laboratory Sample ID	Client Sample ID	Mean Survival (%)	Mean Dry Weight (mg)
12546	BTOX-C-1	90	0.080*
12547	BTOX-C-2	71	0.064*
12548	BTOX-C-3	68*	--
12549	BTOX-D-1	90	0.172
12550	BTOX-D-2	88	0.134*
12551	BTOX-D-3	90	0.168
12552	Laboratory Control Sediment	86	0.223
12589	BTOX-B-1	16*	--
12590	BTOX-B-1 (DUPE)	19*	--
12591	BTOX-B-2	1*	--
12592	BTOX-B-3	64*	--
12593	BTOX-M	10*	--
12609	E-1 Dead Creek	23*	--
12610	E-2 Dead Creek	76	0.664
12611	E-3 Dead Creek	85	0.141*
12612	BP-1 Borrow Pit	89	0.156*
12613	BP-1 Borrow Pit (DUPE)	94	0.154*
12614	BP-3 Borrow Pit	91	0.154*
12622	Laboratory Control Sediment	86	0.202
12638	BP-2 Borrow Pit	96	0.172
12639	F-1 Dead Creek Section F	91	0.221
12640	F-2 Dead Creek Section F	86	0.219
12641	F-3 Dead Creek Section F	83	0.183
12664	Prairie DuPont Creek	98	0.254
12665	Prairie DuPont Creek 2	98	0.404
12666	Reference Creek	98	0.393
12668	Laboratory Control Sediment	98	0.268
12671	Ref 2-2 Reference Borrow Pit	98	0.335

* The response data were statistically significantly different from the corresponding laboratory control sediment ($p \leq 0.05$)

-- When a significant reduction in survival was detected, mean dry weight data were only reported in Appendix A (See Results).

Hyalella azteca Chronic Survival, Growth and Reproduction Toxicity Tests Conducted on Sediment Samples from the Solutia Site, Sauget , Illinois

Reference BTRs 3615, 3622, 3629, 3633, 3641, 3643

Prepared for:
Menzie-Cura & Associates
1 Courthouse Lane, Suite 2
Chelmsford, MA 01824

Aquatec Biological Sciences

Prepared by:
Aquatec Biological Sciences
75 Green Mountain Drive
South Burlington, Vermont

December 1999

EXECUTIVE SUMMARY

100.1HA Amphipod, *Hyalella azteca*, 42-day Chronic Survival, Growth, and Reproduction Test
Conducted October 19 - December 3, 1999
for Menzie-Cura & Associates
Solutia Site, Sauget Illinois

Lab Test ID	Sample ID	Day 28 Mean Survival (%)	Day 28 Mean Dry Weight (mg)	Day 35 Mean Survival (%)	Day 42 Mean Survival (%)	Day 42 Mean Dry Weight (mg)	Day 42 Mean Number of Neonates/ Female
12546	BTOX-C-1	93	0.766	92	87	0.510	11.5
12547	BTOX-C-2	88	0.456	76	73	0.489	3.7
12548	BTOX-C-3	90	0.656	80	76	0.402	3.3
12549	BTOX-D-1	89	0.571	85	84	0.414	5.1
12550	BTOX-D-2	87	0.684	85	81	0.428	4.0
12551	BTOX-D-3	80	0.731	79	79	0.400	3.5
12552	Laboratory Control	55	0.982	51	46	0.231	0.6
12589	BTOX-B-1	23*	--	8*	8*	--	--
12590	BTOX-B-1 (Dup)	22*	--	26*	26*	--	--
12591	BTOX-B-2	Acute Toxicity		--	--	--	--
12592	BTOX-B-3	49*	--	40*	39*	--	--
12593	BTOX-B-M	88	0.481	89	85	0.348	1.6
12609	E-1 Dead Creek	72*	--	63*	56*	--	--
12610	E-2 Dead Creek	97	0.612	94	91	0.462	4.6
12611	E-3 Dead Creek	67*	--	53	50*	--	--
12612	BP-1 Borrow Pit	93	0.594	88	83	0.380	4.1
12613	BP-1 (Dup) Borrow Pit	89	0.636	80	75	0.423	4.2
12614	BP-3 Borrow Pit	95	0.470	86	84	0.322	5.3
12615	Laboratory Control	62	0.296	36	33	0.299	1.8
12622	Laboratory Control	55	0.501	38	35	0.377	4.0
12638	BP-2 Borrow Pit	82	0.563	74	73	0.390	4.3
12639	F1 Dead Creek	91	0.639	89	84	0.397	4.8
12640	F2 Dead Creek	90	0.554	74	70	0.447	3.8
12641	F3 Dead Creek	89	0.661	85	76	0.406	4.8
12664	Prairie DuPont	90	0.443	83	79	0.346	2.6
12665	Praire Dupont 2	89	0.648	85	80	0.498	6.2
12666	Reference Creek	70*	--	64	65	0.459	2.3
12668	Laboratory Control	73	0.477	65	59	0.293	2.2
12671	Ref 2-2 Ref Borrow Pit	87	0.458	85	83	0.351	3.4

* A statistically significant reduction in the response was observed (relative to a corresponding Reference Site response, $P<0.05$).

-- When a significant reduction in survival on Days 28 or 42 was detected, mean dry weight and reproduction data were only reported in Appendix A (See Results).

Results of *Chironomus tentans* Survival and Growth Sediment Toxicity Tests Conducted on Sediment Samples from Dead Creek / Sauget, Illinois

Reference BTRs 3615, 3622, 3629, 3633, 3641, 3643

Prepared for:
Menzie-Cura & Associates
1 Courthouse Lane, Suite 2
Chelmsford, MA 01824

Aquatec Biological Sciences

Prepared by:
Aquatec Biological Sciences
75 Green Mountain Drive
South Burlington, Vermont

December 1999

EXECUTIVE SUMMARY

100.2CT Midge, *Chironomus tentans* 10-day Survival and Growth Test
Conducted October 7 - October 20, 1999
for Menzie-Cura & Associates
Dead Creek Site

Laboratory Sample ID	Client Sample ID	Mean Survival (%)	Mean Dry Weight (mg)
12546	BTOX-C-1	30 *	--
12547	BTOX-C-2	0 *	--
12548	BTOX-C-3	96	2.352
12549	BTOX-D-1	44 *	--
12550	BTOX-D-2	48 *	--
12551	BTOX-D-3	71 *	--
12552	Laboratory Control Sediment	98	2.558
12589	BTOX-B-1	0 *	--
12590	BTOX-B-1 (DUPE)	4 *	--
12591	BTOX-B-2	0 *	--
12592	BTOX-B-3	100 [1]	0.581[1]
12593	BTOX-M	96 *	--
12609	E-1 Dead Creek	91*	--
12610	E-2 Dead Creek	16 *	--
12615	Laboratory Control Sediment	100	1.922
12611	E-3 Dead Creek	97	2.240
12612	BP-1 Borrow Pit	64 *	--
12613	BP-1 Borrow Pit (DUPE)	40 *	--
12614	BP-3 Borrow Pit	53 *	--
12622	Laboratory Control Sediment	94	1.761
12638	BP-2 Borrow Pit	14 *	--
12639	F-1 Dead Creek Section F	31 *	--
12640	F-2 Dead Creek Section F	16 *	--
12641	F-3 Dead Creek Section F	10 *	--
12664	Prairie DuPont Creek	16 *	--
12665	Prairie DuPont Creek 2	55 *	--
12666	Reference Creek	13 *	--
12668	Laboratory Control Sediment	100	2.065
12671	Ref 2-2 Reference Borrow Pit	11 *	--

* The response data were statistically significantly different from the corresponding laboratory control sediment ($p \leq 0.05$).

-- When a statistically significant reduction in survival was detected, mean dry weight data were only reported in Appendix A (See Results).

[1] Indigenous *Chironomus tentans* were present in this sample, resulting in counts higer than the initial number. Statistical analysis of test data for Sample 12592 was not performed.

Chironomus tentans Chronic Survival, Growth, Emergence and Reproduction Toxicity Tests Conducted on Sediment Samples from the Solutia Site, Sauget , Illinois

Reference BTRs 3615, 3622, 3629, 3633, 3641, 3643

Prepared for:
Menzie-Cura & Associates
1 Courthouse Lane, Suite 2
Chelmsford, MA 01824

Prepared by:
Aquatec Biological Sciences
75 Green Mountain Drive
South Burlington, Vermont

December 1999

EXECUTIVE SUMMARY

100.5CT Midge, *Chironomus tentans* Chronic Survival, Growth, Emergence, and Reproduction
Conducted October 19 - December 14, 1999
for Menzie-Cura & Associates
Solutia Site, Sauget, Illinois

Laboratory Sample ID	Client Sample ID	Day 20 Mean Survival (%)	Day 20 Mean Ash Weight (mg)	Emergence Proportion (%)	Mean Eggs Hatched/ Female	Mean Days Survived, Female	Mean Days Survived, Male
12546	BTOX-C-1	Acute Toxicity		--	--	--	--
12547	BTOX-C-2	Acute Toxicity		--	--	--	--
12548	BTOX-C-3	63	3.186	56	526	2.4	3.7
12549	BTOX-D-1	Acute Toxicity		--	--	--	--
12550	BTOX-D-2	31	0.937*	2*	0*	0.8*	0*
12551	BTOX-D-3	42*	--	10*	298	0.6*	1.1*
12552	Laboratory Control	81	2.679	50	130	2.8	4.5
12589	BTOX-B-1	Acute Toxicity		--	--	--	--
12590	BTOX-B-1 (DUPE)	Acute Toxicity		--	--	--	--
12591	BTOX-B-2	Acute Toxicity		--	--	--	--
12592	BTOX-B-3	52	2.244	52	302	2.5	3.1
12593	BTOX-M	40	2.216	54	430	3.6	4.1
12609	E-1 Dead Creek	54	2.501	42	576	3.5	2.4
12610	E-2 Dead Creek	Acute Toxicity		--	--	--	--
12611	E-3 Dead Creek	0*	--	1*	0*	0.6*	0*
12612	BP-1 Borrow Pit	0*	--	5*	0*	0*	0.7*
12613	BP-1 Borrow Pit (DUPE)	0*	--	8*	127*	0.3*	0.8*
12614	BP-3 Borrow Pit	6*	--	14*	106*	0.8*	1.2*
12622	Laboratory Control	46	2.959	45	554	3.1	4.9
12638	BP-2 Borrow Pit	Acute Toxicity		--	--	--	--
12639	F-1 Dead Creek Section F	Acute Toxicity		--	--	--	--
12640	F-2 Dead Creek Section F	Acute Toxicity		--	--	--	--
12641	F-3 Dead Creek Section F	Acute Toxicity		--	--	--	--
12664	Prairie DuPont Creek	Acute Toxicity		--	--	--	--
12665	Prairie DuPont Creek 2	69	3.074	13*	249	1.1*	1.4*
12666	Reference Creek	Acute Toxicity		--	--	--	--
12668	Laboratory Control	65	2.923	69	354	3.6	4.3
12671	Ref 2-2 Ref. Borrow Pit	Acute Toxicity		--	--	--	--

The response data were statistically significantly different from the corresponding laboratory control sediment ($p \leq 0.05$).

-- When a statistically significant reduction in survival was detected, mean ash-free dry weight data were only reported in Appendix A.

APPENDIX F

FOOD CHAIN MODEL INFORMATION AND RESULTS

Appendix F
Food Chain Model Overview

The following food chain models and assumptions are used to estimate exposure of wildlife species to Chemicals of Potential Concern (COPCs) via the food chain. The models apply to select species that may use the aquatic environments of Dead Creek and the Borrow Pit Lake of Sauget Area I. The selected species have also been chosen to represent different feeding guilds. The wildlife species for which food chain models were applied are described in Table F-1. This appendix describes the food chain models used in this assessment, presents the exposure parameters, and toxicity reference values for wildlife (Tables F-2 and F-3). The last section of this appendix is the results of the food chain modeling.

Table F-1. Wildlife species used to assess ecological risks

Species	Feeding Guild	Primary Habitat	Use in ERA
Great Blue Heron	Eats fish and other small animals	Aquatic	Evaluate exposure to COPCs in aquatic food webs
Mallard Duck	Eats plants and invertebrates	Aquatic	Evaluate exposure to COPCs in aquatic plants and invertebrates
Bald Eagle	Eats fish and other smaller birds and mammals	Aquatic	Evaluate exposure to COPCs in aquatic food webs
Muskrat	Eats plants and some invertebrates (e.g., clams)	Aquatic	Evaluate exposure to COPCs in aquatic plants and in invertebrates
River Otter	Eats fish, other small animals and some invertebrates	Aquatic	Evaluate exposures to COPCs in fish and invertebrates

Model Structure

The general form of the wildlife exposure model is:

Exposure Dose (oral) = $\{ [Conc_{food} * Ingest_{food}] + [RAF * Conc_{soil} * Sediment_{diet} * Ingest_{food}] + [Conc_{water} * Ingest_{water}]\} * f_{migration}\ x * f_{foraging\ area}$

Where:

Exposure Dose (oral) = dose of a COPC in ug/g-day

$Conc_{food}$ = concentration of the COPC (ug/g) in the food (measured or estimated); this is the average and maximum concentration in the relevant exposure zone, an area determined by the size and locations of foraging areas. The average is the appropriate statistic because ecological receptors integrate exposure over their foraging areas. We will also use the maximum concentration and calculate risk from this exposure separately. We will not use the 95% upper confidence limit (UCL) on the mean because of the low number of samples collected from each exposure area and medium.

$Ingest_{food}$ = amount of food ingested per day normalized to body weight (g/g-day) and usually expressed in terms of wet weight of food/live body weight.

RAF – relative availability factor for COPCs in sediment via incidental ingestion of sediment.

$Conc_{sediment}$ = concentration ug/g in the relevant exposure zone; this is estimated as an average concentration in the exposure zone for chronic exposure and effects, and a maximum for evaluation of short-term or acute exposures. The average is the appropriate statistic because ecological receptors integrate exposure over their foraging areas.

$Sediment_{diet}$ = fraction of sediment in the diet; the product of this number and $Ingest_{food}$ yields an estimate of the amount of sediment that is incidentally ingested during foraging, grooming, etc.

$Conc_{water}$ = concentration mg/L in the relevant exposure zone; the exposure concentration is the average surface water concentration;

$Ingest_{water}$ = drinking water ingestion rate in L/kg/day; the $ingest_{water}$ x $conc_{water}$ yields an estimate of the amount of water that is ingested as drinking water. The drinking water component is in addition to other water sources. USEPA (1993) states that "under some conditions, some species can meet their water requirements with only the water contained in the diet and metabolic water production".

$F_{migration}$ = the number of months the time the species spends in the area over 12 months; for a species that doesn't migrate, this value is 1.

$F_{foraging}$ area = the ratio of the area of the site to the species foraging area. If this value is greater than 1, it can be assumed to be equal to 1 or, if sufficient data are available, the site can be subdivided into smaller foraging areas.

Incidental Sediment Ingestion Rate Estimation

The wildlife sediment ingestion values applied in the food chain models are from Beyer et al. (1994) and are a percentage of the dry mass of food ingested per day.

For the receptors at Dead Creek and the Borrow Pit Lake (except the mallard), the food ingestion rate is given as grams of wet food/gram of body weight/day, and these food ingestion rates are applied in the model.

To estimate a soil ingestion rate, we assumed a moisture content of fish and clams of about 80% (percent solids of 20%) and a moisture content of plants of about 70% (percent solids of 30%). These values are used to convert the receptor's food ingestion rate from wet weight to dry weight, and then calculate a soil ingestion rate from the proportion estimated by Beyer et al (1994). For example, a river otter that eats a diet of 100% fish at a rate of 0.1 g wet food/g body weight/day, will have a dry food consumption rate of:

0.1 g wet food/g body weight/day x 0.2 g dry food/g wet food = 0.02 g dry food/g body weight/day

If the otter ingests 2% of the dry mass of its diet as sediment, the resulting sediment ingestion weight is:

0.02 g dry food/g body weight/day x 0.02 g sediment/g dry food ingested = 0.0004 g dry sediment/g body weight/day

This can be used directly with the dry weight concentration of sediment to calculate an exposure dose.

[Note: the mallard's food ingestion rate is given on a dry weight basis, so we only need to take 2% or 10% of that value to estimate their sediment ingestion rate. The mallard's food ingestion rate has to be converted to wet weight for shrimp or plant ingestion.]

Model Application

The model will be applied in several ways:

1. Potential maximum exposure: The potential for maximum exposure is considered without incorporating information on foraging area or migration.

2. Chronic exposure of individuals: The potential for chronic exposure to individuals is considered by calculating an average concentration for food and sediments at spatial scales defined by the foraging areas of the species. For example, exposure concentrations for a species with a foraging area of 10 ha would be determined by averaging the food and

sediments concentrations within this spatial scale. A species with a foraging area of 0.1 ha would have an averaging area that is 100 times less. As a simplifying assumption, the health of an individual is assumed to be reflective of the health of a subpopulation. Comparisons to criteria and guidelines and the additional components of the weight-of-evidence approach also provide insights into population health.

3. Chronic exposures of the bald eagle. Because the bald eagle is rare and the risk to the individual is considered, the wildlife exposure model will also be used to estimate exposures to the individual.

Model Parameters for Wildlife Species

Great Blue Heron Model

Food Habits: 100% of various fish species. This is a simplifying assumption because herons eat other animals as well. In marsh environments, the great blue heron is an opportunistic feeder; they prefer fish, but they will also eat amphibians, reptiles, crustaceans, insects, birds, and mammals. The diet varies but may include up to 100% fish. A Nova Scotia study found 6% forage fish (Atlantic silverside and mummichog), 52.6% eels, and 41.4% other fish in the diet of great blue heron (USEPA, 1993). However, fish are their main diet. Based on information presented in USEPA (1993), we assume that the great blue heron's diet consists of 27% larger fish such as brown bullhead and largemouth bass and 73 % small minnows.

Food Ingestion Rate: 0.18 g/g-day. This is the estimate of food consumption calculated using Kushlan's equation for wading birds as reported in USEPA (1993).

Incidental sediment ingestion: Because blue herons feed primarily on fish, estimated sediment consumption is presumed to be negligible.

Water Ingestion Rate: 0.045 L/kg/day. This water ingestion rate was estimated using the allometric relationship developed by Calder and Braun (1983) in USEPA (1993) with a body weight from Quinney (1982).

Foraging Area: Great blue heron tend to forage near nesting sites (USEPA, 1993).
No wading bird colonies were located within the study area. However, the Illinois Natural Heritage Inventory has documented two 1000-2000 nest mixed-species colonies in East St. Louis. The closer of these two colonies is approximately one mile east of Sauget Area I near the Alton & Southern rail yards in Alorton. The second site is over two miles to the north at Audubon Avenue and 26th Street. These two colonies contain the only breeding little blue heron and snowy egret in Illinois. In addition, black-crowned night heron, great egret, cattle egret, great blue heron, and green-backed heron nest in the colonies.

A study in Minnesota measured the distance between nesting and foraging grounds to range from 0 to 2.7 miles. A Carolina study found the same distance to be 4 to 5 miles. The maximum distance great blue heron will fly between foraging areas is 9 to 13 miles (USEPA, 1993). The size of the feeding territory in a freshwater area in Oregon was 0.6 to 8.4 hectares (USEPA, 1993). It appears that the feeding territories of great blue heron are variable. Some colonies may feed in one particular area while others will feed anywhere prey is available within a radius of at least several miles. This assessment uses the reported 0.6 to 8.4 hectares feeding area. As a sensitivity analysis, it also uses a feeding area with a radius of 3 miles (7,300 hectares).

Migration history: Great blue herons arrive in Illinois near St. Louis in mid-February and stay through October (INHS, 2000).

Mallard Duck Model

Food Habits: The mallard feeds (usually in shallow water) by "tipping up" and eating food off the bottom of the water body. Primarily, it consumes aquatic plants and seeds (for instance, primrose willow and bulrush seeds), but it will also eat aquatic insects, other aquatic invertebrates, snails and other molluscs, tadpoles, fishes, and fish eggs. Ducklings and breeding females consume mostly aquatic invertebrates. We assess a diet of plant in Dead Creek Section F and a diet of shrimp in the Borrow Pit Lake. We assume that the clams that inhabit the Borrow Pit Lake are too large for a mallard to consume.

Food ingestion rate: 0.08 g/g-day. This ingestion rate is based on the dry weight of food. However, wet weight ingestion rates are applied in the food chain model. Assuming that the water content of plants is 70% (30% solids) and is 80% (20% solids) for invertebrate tissue, the equivalent wet weight ingestion rate for plant material is 0.3 g/g-day and 0.4 g/g-day for invertebrate tissue.

Incidental sediment ingestion: Beyer et al. (1994) estimated that the incidental ingestion of soil/sediment by mallard ducks is less than 2% of their diet. For the model, we assumed an incidental sediment ingestion rate of 2%.

Water Ingestion Rate: 0.0565 L/kg/day. The value is the average of male and female water ingestion rates estimated by USEPA (1993) using the allometric relationship for birds from Calder and Braun (1983). The body weights were selected by USEPA from Nelson and Martin (1953).

Foraging Area: The foraging area for the mallard varies depending on the type and distribution of water habitat and population density (Bellrose, 1976; Dwyer et al., 1979; Kirby et al., 1985 In USEPA 1993). The mallard's home range is variable, but an approximate range is 580 hectares. It prefers to nest on ground sheltered by dense grass-like vegetation, near the water.

Migration information: In this region of Illinois, some mallards are present year round while other mallards that breed farther to the north overwinter in the area (USEPA, 1993). This assessment assumes that mallards do not migrate from the area.

Bald Eagle Model

Bald eagles, although primarily carrion feeders, are opportunistic and will eat whatever is plentiful including fish, birds, and mammals. Reported food ingestion rates range from 0.064 to 0.14 g/g/day. A study of adult breeding bald eagles in Connecticut estimated a food ingestion rate of 0.12 g/g/day (USEPA, 1993). A study of bald eagle diets in Maine indicated that their diets consisted of 76.7% fish, 16.5% birds, and 6.8% mammals (USEPA, 1993). In this assessment we have assumed a food ingestion rate of 0.12 g/g/day.

Incidental sediment ingestion: We assume that a bald eagle does not incidentally ingest sediment while feeding.

Water ingestion rate: USEPA (1993) reports a water ingestion rate of 0.037 l/kg/day.

Foraging area: Foraging areas vary according to season and location. The USEPA (1993) reports a foraging length of 2 to 4.5 miles along a river. A foraging area of 1,880 hectares has been reported for a Missouri lake in winter (USEPA, 1993).

Migration information: Bald eagles overwinter in the Mississippi River valley from October through March.

Muskrat Model

Food Habits: The muskrat feeds largely on aquatic plants, but depending on location and time of year may also consume aquatic invertebrates (crayfish, crabs, etc.), small amphibians, turtles, fish, mollusks, and even young birds. The muskrat lives quite close to the water, either on the bank of the water body or constructing a lodge in the water body. Plant matter composes from 95 to 100% of their food intake, with the preferred plants being cattail and rush. Animals in the diet can include crayfish, fish, frogs, turtles, and young birds (USEPA, 1993). For the model, we assumed a diet that is comprised of plant matter Dead Creek Section F and clams in the Borrow Pit Lake.

Food Ingestion Rate: Muskrats are reported to eat greens in the amount of 0.34 g/g-d and a mixed diet of greens and corn in an amount of 0.26 g/g-d (Svihla and Svihla, 1931). We used 0.34 g/g-day wet weight.

Incidental sediment ingestion: We assumed an incidental sediment ingestion rate of 2% of the diet for this species. This is based on reported values for other herbivorous rodents including the woodchuck (less than 2%), meadow vole (2.4%), white-footed mouse (less than 2 %), and white-footed prairie dog (2.7%) (Beyer et al., 1994). The large herbivorous mammals included in the Beyer et al. (1994) study also had incidental soil ingestion rates of less than 2%. Mammals with higher soil ingestion rates include the black-footed prairie dog (7.7%), nine-banded armadillo (17%), opossum (5.4%), and raccoon (9.4%). These species eat mixed diets and probably engage in digging activities to obtain their food. The incidental sediment ingestion rate is 0.002 g/g-day dry weight assuming that soil ingestion is 2% of food ingestion based on a plant ingestion rate.

Water Ingestion Rate: 0.98 L/kg/day. USEPA (1993) applies the allometric relationship for mammals from Calder and Braun (1983). The body weights were selected by USEPA from Sather (1958).

Foraging Area: Muskrat have been reported to forage within 5 to 10 m from their den (Wilner et al., 1980). MacArthur (1978) reported that this species is found within 15m of their home 50% of the time. Its home range is small (0.17 hectares on average).

River Otter Model

Food Habits: The diet of the river otter consists primarily of aquatic animals, e.g. fish (93 – 100% of diet), although they may consume small numbers of crustaceans, aquatic insects, young mammals and turtles. A relative of the otter, the mink, has similar feeding habits but will eat more mammals (e.g., muskrat and meadow voles) and birds. Otters have also been observed to consume waterfowl in the northerly latitudes. (USEPA, 1993). For the model, the diet of river otter is assumed to consist of 100% fish.

Food Ingestion Rate: Food intake has been reported to range between 700 to 900g of food daily in captivity (Harris, 1968). The average body size of river otter is reported to range from about 8 to 9 kg for males and from about 7 to 8 kg for females. For the purpose of the model, we assumed an ingestion rate of 800 g/day (the middle of the range) and a body weight of 8 kg (again the middle of the range). This yields an ingestion rate of 0.1 g/g-day wet weight for the otter.

Incidental sediment ingestion: The river otter is expected to feed primarily on fish and incidental sediment ingestion is expected to be negligible. However, otters are known to eat clams and therefore some sediment ingestion may occur. Consistent with the expectation that incidental sediment ingestion rate is low, we used a sediment ingestion rate of 2% of the diet. This is the same value used for the muskrat. The incidental sediment ingestion rate is 0.0004 g/g-day dry weight assuming that soil ingestion is 2% of food ingestion based on a 100% fish diet.

Water Ingestion Rate: 0.08 L/kg/day. EPA (1993) applies the allometric relationship for mammals from Calder and Braun (1983). The body weights were selected by USEPA from Lauhachinda (1978).

Foraging Area: This varies by habitat type. On long shorelines, it can encompass kilometers, or it can measure in hectares in marshes or small stream areas. These areas generally contain smaller areas of concentrated activity (USEPA 1993). The otter dens in banks, in hollow logs, or similar burrow-like places. Home range varies depending on habitat and sex. A range of 400 to 1,900 hectares has been reported for Missouri marshes and streams (USEPA, 1993).

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TABLE F-2
Toxicological Endpoints for Birds
Dead Creek Ecological Risk Assessment
Sauget Area I

Compound	CHRONIC							
	Chemical Form	Test Species	Exposure Route	Exposure Duration (Days unless noted)	Endpoint	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Source
Herbicides								
2,4-D						NA	NA	
Dicamba						NA	NA	
Dichloroprop						NA	NA	
MCPA						NA	NA	
MCPP						NA	NA	
Metals								
Aluminum, Total	$Al_2(SO_4)_3$	Ringed Dove	Incorporation into Food	116	Reproduction	109.7	NA	Sample et al., 1996
Antimony, Total						NA	NA	
Arsenic, Total	Sodium Arsenite	Mallard Duck	Incorporation into Food	128	Mortality	5.14	12.84	Sample et al., 1996
Barium, Total	Barium Hydroxide	1 day old Chick	Incorporation into Food	4 weeks; subchronic to chronic factor of 0.1 applied to data by authors	Mortality	20.8	41.7	Sample et al., 1996
Cadmium, Total	Cadmium Chloride	Mallard Duck	Incorporation into Food	90	Reproduction	1.45	20	Sample et al., 1996
Chromium, Total	Trivalent	Black Duck	Incorporation into Food	290	Reproduction	1	5	Sample et al., 1996
Copper, Total	*Copper Oxide*	*1 day old Chick*	*Incorporation into Food*	70	Growth, Mortality	47.0	61.7	Sample et al., 1996
Iron						NA	NA	
Lead, Total	**Acetate**	**Japanese Quail**	Incorporation into Food	84	Reproduction	1.13 [a]	11.3	Sample et al., 1996
Manganese	Mn_3O_4	**Japanese Quail**	Incorporation into Food	75	Growth, Behavior	977	NA	Sample et al., 1996
Molybdenum	Sodium Molybdate	Chicken	Incorporation into Food	21 days through reproduction	Reproduction	3.5 [a]	35.3	Sample et al., 1996
Nickel, Total	Nickel Sulfate	Mallard Duckling	Incorporation into Food	90	Mortality, Growth, Behavior	77.4	107	Sample et al., 1996
Silver, Total						NA	NA	
Zinc, Total	Zinc Sulfate	White Leghorn Hen	Incorporation into Food	308	Reproduction	14.5	131	Sample et al., 1996
Mercury, Total	Mercuric Chloride	Japanese Quail	Incorporation into Food	365	Reproduction	0.45	0.9	Sample et al., 1996
Methyl mercury	Methyl Mercury *Dicyandiamide*	*Mallard Duck*	*Incorporation into Food*	3 generations	Reproduction	0.0064 [a]	0.064	Sample et al., 1996
PCBs								
Total PCB	Aroclor 1254	Ring-necked Pheasant	Incorporation into Food	119	egg hatchability	0.18 [a]	1.8	Dahlgren et al., 1972
Pesticides								
Total DDT	NA	Brown Pelican	Incorporation into Food	5 years	Reproduction	0.0028	0.028	Sample et al., 1996.
Aldrin						NA	NA	
alpha-Chlordane	Chlordane	*Red-winged Blackbird*	*Incorporation into Food*	84	*Mortality*	*2.14*	*10.7*	*Sample et al., 1996*
delta-BHC	BHC - mixed isomers	Japanese Quail	Incorporation into Food	90	Reproduction	0.56	2.25	Sample et al., 1996
Dieldrin	Dieldrin	Barn Owl	Incorporation into Food	730	Reproduction	0.077	NA	Sample et al., 1996
Endosulfan I	Endosulfan	Gray Partridge	Incorporation into Food	28 during critical life stage = chronic	Reproduction	10	NA	Sample et al., 1996
Endosulfan II	*Endosulfan*	Gray Partridge	Incorporation into Food	28 during critical life stage = chronic	Reproduction	10	NA	Sample et al., 1996
Endosulfan sulfate	Endosulfan	Gray Partridge	Incorporation into Food	28 during critical life stage = chronic	Reproduction	10	NA	Sample et al., 1996
Endrin aldehyde	Endrin	Screech Owl	Incorporation into Food	> 83	Reproduction	0.01 [a]	0.1	Sample et al., 1996
Endrin ketone	Endrin	Screech Owl	Incorporation into Food	> 83	Reproduction	0.01 [a]	0.1	Sample et al., 1996
gamma-Chlordane	Chlordane	Red-winged Blackbird	Incorporation into Food	84	Mortality	2.14	10.7	Sample et al., 1996
gamma-BHC (Lindane)	NA	Mallard Duck	Oral intubation	56	Reproduction	2 [a]	20	Sample et al., 1996
Heptachlor						NA	NA	
Heptachlor epoxide						NA	NA	
Methoxychlor						NA	NA	

TABLE F-2
Toxicological Endpoints for Birds
Dead Creek Ecological Risk Assessment
Sauget Area I

Compound	CHRONIC							
	Chemical Form	Test Species	Exposure Route	Exposure Duration (Days unless noted)	Endpoint	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Source
Semivolatiles								
bis(2-Ethylhexyl)phthalate	Bis(2-ethylhexyl)phthalate	Ringed Dove	Incorporation into Food	28 during critical life stage = chronic	Reproduction	1.1	NA	Sample et al., 1996
Di-n-butylphthalate	NA	Ringed Dove	Incorporation into Food	28	Reproduction	0.11 a	1.1	Sample et al., 1996
Diethylphthalate						NA	NA	
Total PAHs	Mix of PAHs	Mallard Duck	Oral	203	Increased Liver Weight	40 [a]	400	Eisler, 1987
Dioxin TEQ	2,3,7,8-TCDD	Ring-necked Pheasant	Intraperitoneal	70	Fertility, Embryo Mortalitiy	1.4E-05	0.00014	Nosek et al., 1992

NA = Not Available
TEF = Toxicity equivalency factor
[a] NOAEL value was derived by applying a LOAEL to NOAEL Ratio of 10 to the LOAEL value.

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TABLE F-3
Toxicological Endpoints for Mammals
Sauget Area I Ecological Risk Assessment

	CHRONIC								
	Test Species								
Compound	**Exposure Route**	**Effect Endpoint**	**Exposure Duration (Days unless noted)**	**Chemical Form**	**Test Species**	**Body Weight[a] (kg)**	**NOAEL (mg/kg/d)**	**LOAEL (mg/kg/d)**	**Reference**
Herbicides									
2-4,D	Oral-diet	Blood, kidney, and liver toxicity	90 days	2,4-D	Rat	0.35	1	5	IRIS, 2000
Dicamba	Oral-diet	Reproduction	13 days - gestation	Dicamba	Rabbit	1.2	0.3	1	IRIS, 2000
Dichloroprop							NA	NA	
MCPA	Oral - diet	Reproduction	2 generations	MCPA	Rat	0.35	7.5	22.5	IRIS, 2000
MCPP	Oral-diet	Renal effects	90 days	MCPP	Rat	0.35	3	9	IRIS, 2000
Metals									
Aluminum, Total	Oral-water	Reproduction	3 generations	Aluminum Chloride	Mouse	0.03	1.93 b	19.3	Sample et al., 1996
Antimony, Total	Oral-water	Longevity	lifetime (>1yr)	Antimony Potassium Tartrate	Mouse	0.03	0.125 b	1.25	Sample et al., 1996
Arsenic, Total	Oral-diet	Growth	730	Arsenite	Rat	0.35	2.5	NA	Byron et al. 1967
Barium, Total	Oral-gavage	Mortality	10	Barium Chloride	Rat	0.35	13.8 c	19.8 c	Borzelleca et al., 1988
Cadmium, Total	Oral-gavage	Reproduction	42	Cadmium Chloride	Rat	0.303	1	10	Sample et al., 1996
Chromium, Total	Oral-diet	Reprod/Longevity	730	Trivalent Chromium	Rat	0.35	2737	NA	Sample et al., 1996
Copper, Total	Oral-diet	Reproduction	357	Copper Sulfate	Mink	1	11.7	15.14	Sample et al., 1996
Iron			NA				NA	NA	
Lead, Total	Oral-diet	Reproduction	3 generations	Lead Acetate	Rat	0.35	8	80	Sample et al., 1996
Manganese	Oral-diet	Reproduction	224 days	Manganese Oxide	Rat	0.35	88	284	Sample et al., 1996
Molybdenum	Oral - water	Reproduction	3 generations	Molybdate	Mouse	0.03	0.26 b	2.6	Sample et al., 1996
Nickel, Total	Oral-diet	Reproduction	3 generations	Nickel Sulfate Hexahydrate	Rat	0.35	40	80	Sample et al., 1996
Silver, Total	Oral-water	Body Weight	259	NA	Rat	0.35	22 b	222.2	ATSDR, 2000
Zinc, Total	Oral-diet	Reproduction	16 days of gestation	Zinc Oxide	Rat	0.35	160	320	Sample et al., 1996
Mercury, Total	Oral-diet	Reproduction	168	Mercuric Chloride	Mink	1	1	NA	Sample et al., 1996
Methyl mercury	Oral-diet	Reproduction	3 generations	Methyl Mercury Chloride	Rat	0.35	0.032	0.16	Sample et al., 1996
PCBs									
Aroclor-1254	Oral-diet	Reproduction	5-9 mo	Arochlor 1254	Mink	1	0.14	0.28	Aulerich and Ringer, 1977
Pesticides									
Total DDT	Oral-diet	Reproduction	730	DDT	Rat	0.35	0.8	4	Sample et al., 1996
Aldrin	Oral - diet	Reproduction	3 generations	NA	Rat	0.35	0.2	1	Sample et al., 1996
a-Chlordane	Oral-diet	Reproduction	6 generations	Chlordane	Mouse	0.03	4.6	9.2	Sample et al., 1996
delta-BHC	Oral-diet	Reproduction	331 days	BHC mixed isomers	Mink	1	0.014 b	0.14	Sample et al., 1996
Dieldrin	Oral-diet	Reproduction	3 generations	NA	Rat	0.35	0.02 b	0.2	Sample et al., 1996
Endosulfan I	Oral intubation	Reproduction/blood chemistry	30 days	Endosulfan	Rat	0.35	0.15 c	NA	Sample et al., 1996
Endosulfan II	Oral intubation	Reproduction/blood chemistry	30 days	Endosulfan	Rat	0.35	0.15 c	NA	Sample et al., 1996
Endosulfan sulfate	Oral intubation	Reproduction/blood chemistry	30 days	Endosulfan	Rat	0.35	0.15 c	NA	Sample et al., 1996
Endrin aldehyde	Oral - diet	Reproduction	120 days	Endrin	Mouse	0.03	0.092 b	0.92	Sample et al., 1996
Endrin ketone	Oral - diet	Reproduction	120 days	Endrin	Mouse	0.03	0.092 b	0.92	Sample et al., 1996
gamma-Chlordane	Oral-diet	Reproduction	6 generations	Chlordane	Mouse	0.03	4.6	9.2	Sample et al., 1996
gamma-BHC (Lindane)	Oral-diet	Reproduction	3 generations	Lindane	Rat	0.35	8	NA	Sample et al., 1996
Heptachlor	Oral-diet	Reproduction	181 days	Heptachlor	Mink	1	0.1 b	1	Sample et al., 1996
Heptachlor epoxide	Oral-diet	Reproduction	181 days	Heptachlor	Mink	1	0.1 b	1	Sample et al., 1996
Methoxychlor	Oral-diet	Reproduction	11 month	Methoxychlor	Rat	0.35	4	8	Sample et al., 1996
Semivolatiles									
bis(2-Ethylhexyl)phthalate	Oral-diet	Reproduction	105 days	NA	Mouse	0.03	18.3	183	Sample et al., 1996
Di-n-butylphthalate	Oral - diet	Reproduction	105 days	NA	Mouse	0.03	550	1833	Sample et al., 1996
Diethylphthalate	Oral - diet	Reproduction	105 days	NA	Mouse	0.03	4583	NA	Sample et al., 1996
Acenaphthylene							NA	NA	
Fluoranthene	Oral-gavage	Reproduction	91	NA	Mouse	0.03	500	NA	ATSDR, 2000
Benzo[b]fluoranthene							NA	NA	
Benzo[k]fluoranthene							NA	NA	
Benzo[a]pyrene	Oral-intubation	Reproduction	10 days of gestation	NA	Mouse	0.03	1 b	10	Sample et al., 1996
Indeno[1,2,3-cd]pyrene							NA	NA	
Dibenz[a,h]anthracene							NA	NA	
Total PAH							NA	NA	
TEQ	Oral-diet	Pup Weight, Litter Size	3 generations	2,3,7,8-TCDD	Rat	0.35	0.000001	0.00001	Murray et al., 1979

TABLE F-3
Toxicological Endpoints for Mammals
Sauget Area I Ecological Risk Assessment

Compound	RIVER OTTER			MUSKRAT		
	Body Weight (kg)	Final NOAEL (mg/kg/d)	Final LOAEL (mg/kg/d)	Body Weight (kg)	Final NOAEL (mg/kg/d)	Final LOAEL (mg/kg/d)
Herbicides						
2-4,D	7.4	0.47	2.3	1.274	0.72	3.6
Dicamba	7.4	0.19	0.63	1.274	0.30	1.0
Dichloroprop						
MCPA	7.4	3.5	10	1.274	5.4	16
MCPP	7.4	1.4	4.2	1.274	2.2	6.5
Metals						
Aluminum, Total	7.4	0.49	4.9	1.274	0.76	7.6
Antimony, Total	7.4	0.032	0.32	1.274	0.049	0.49
Arsenic, Total	7.4	1.2	NA	1.274	1.8	NA
Barium, Total	7.4	6.4	9.2	1.274	10	14
Cadmium, Total	7.4	0.45	4.5	1.274	0.70	7.0
Chromium, Total	7.4	1276	NA	1.274	1982	NA
Copper, Total	7.4	7.1	9.2	1.274	11	14
Iron						
Lead, Total	7.4	3.7	37	1.274	5.8	58
Manganese	7.4	41	132	1.274	64	206
Molybdenum	7.4	0.066	0.66	1.274	0.10	1.0
Nickel, Total	7.4	19	37	1.274	29	58
Silver, Total	7.4	10	104	1.274	16	161
Zinc, Total	7.4	75	149	1.274	116	232
Mercury, Total	7.4	0.61	NA	1.274	0.94	NA
Methyl mercury	7.4	0.015	0.075	1.274	0.02316726	0.12
PCBs						
Aroclor-1254	7.4	0.085	0.17	1.274	0.13	0.26
Pesticides						
Total DDT	7.4	0.37	1.9	1.274	0.58	2.9
Aldrin	7.4	0.093	0.47	1.274	0.14	0.72
a-Chlordane	7.4	1.2	2.3	1.274	1.8	3.6
delta-BHC	7.4	0.0085	0.085	1.274	0.013	0.13
Dieldrin	7.4	0.0093	0.093	1.274	0.014	0.14
Endosulfan I	7.4	0.070	NA	1.274	0.11	NA
Endosulfan II	7.4	0.070	NA	1.274	0.11	NA
Endosulfan sulfate	7.4	0.070	NA	1.274	0.11	NA
Endrin aldehyde	7.4	0.023	0.23	1.274	0.036	0.36
Endrin ketone	7.4	0.023	0.23	1.274	0.036	0.36
gamma-Chlordane	7.4	1.2	2.3	1.274	1.8	3.6
gamma-BHC (Lindane)	7.4	3.7	NA	1.274	5.8	NA
Heptachlor	7.4	0.061	0.61	1.274	0.094	0.94
Heptachlor epoxide	7.4	0.061	0.61	1.274	0.094	0.94
Methoxychlor	7.4	1.9	3.7	1.274	2.9	5.8
Semivolatiles						
bis(2-Ethylhexyl)phthalate	7.4	4.6	46.1767617	1.274	7.2	72
Di-n-butylphthalate	7.4	139	462.524613	1.274	215	718
Diethylphthalate	7.4	1156	NA	1.274	1795	NA
Acenaphthylene	7.4	NA	NA	1.274	NA	NA
Fluoranthene	7.4	126	NA	1.274	196	NA
Benzo[b]fluoranthene	7.4	NA	NA	1.274	NA	NA
Benzo[k]fluoranthene	7.4	NA	NA	1.274	NA	NA
Benzo[a]pyrene	7.4	0.25	2.5	1.274	0.39	3.9
Indeno[1,2,3-cd]pyrene	7.4	NA	NA	1.274	NA	NA
Dibenz[a,h]anthracene	7.4	NA	NA	1.274	NA	NA
Total PAH	7.4	NA	NA	1.274	NA	NA
TEQ	7.4	4.66347E-0[illegible]	[illegible]635E-06	1.274	7.2398E-07	7.23977E-06

Notes:

[a]If the test species' body weight was not identified in the study than the following values were used: Rat = 0.35kg, Mouse = 0.03kg, Mink = 1.0kg
[b]*NOAEL value was derived by applying a LOAEL to NOAEL Ratio of 10 to the LOAEL value.*
[c]Converted from subchronic to chronic value by division by uncertainty factor of 10.
NA = Not Available/Not Applicable
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level

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Appendix F
Food Chain Model For
Mallard Duck Ingesting Plants in Dead Creek Section F - Average Concentrations
Sauget Area I

									Food[1]								Sediment[2]				Water[3]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Dose mg/kg/day	Ratio of Site to Forage Area	Ratio of Time on Site	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Invertebrate Tissue mg/kg	Proportion Inverts In Diet	Plant Concentration mg/kg	Proportion Plant In Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	NB	NB	NA	NA	1 84E-08	0.0005	1	0 0000368	0.0000				1.0	0.30	0.00	1.0	0.023	0.0016	1 0		0.057	0 000
Dicamba	NB	NB	NA	NA	0	0.0005	1	0	0.0000				1.0	0.30	0 00	1.0		0 0016	0.00		0.057	0 000
Dichloroprop	NB	NB	NA	NA	1.05E-06	0 0005	1	0.0021	0.0070			0.0070	1 0	0 30	1.0	1.0		0.0016	0.00		0.057	0 000
MCPA	NB	NB	NA	NA	0	0.0005	1	0	0 0000				1.0	0.30	0.00	1 0		0.0016	0.00		0.057	0.000
MCPP	NB	NB	NA	NA	0	0.0005	1	0	0.0000				1.0	0.30	0 00	1.0		0.0016	0 00		0.057	0.000
Aluminum, Total	1 E-04	NB	109.7	NA	0.0159	0 0005	1	31.8	37			37	1 0	0.30	0.35	1.0	12933	0.0016	0.65	0.25	0.057	0 000
Antimony	NB	NB	NA	NA	1.99E-05	0.0005	1	0 0397	0.12			0.12	1.0	0.30	0.87	1 0	3.3	0.0016	0 13		0.057	
Arsenic, Total	2.E-05	7.E-06	5.1	12 84	8.48E-05	0.0005	1	0.170	0.49			0.49	1.0	0.30	0.87	1.0	14	0.0016	0.13	0.0044	0.057	0.0015
Barium, Total	9 E-06	4.E-06	20.8	41.7	0.000182	0.0005	1	0.364	0.0000				1.0	0.30	0.00	1.0	223	0.0016	0.98	0.13	0.057	0.020
Cadmium, Total	2.E-05	2.E-06	1 45	20	3.28E-05	0.0005	1	0.0658	0.097			0.097	1.0	0.30	0 44	1.0	23	0 0016	0.56		0.057	0 000000
Chromium, Total	2.E-05	5 E-06	1.00	5.00	0.0000232	0.0005	1	0.0464	0.0000				1.0	0.30	0.00	1.0	29	0.0016	1.0		0 057	0.000
Copper, Total	1.E-05	8.E-06	47.0	61.7	0.000516	0.0005	1	1.03	2			2	1.0	0.30	0.58	1.0	270	0.0016	0 42	0.0052	0.057	0.000
Iron	NB	NB	NA	NA	0.0166	0.0005	1	33.1	0.0000				1.0	0.30	0.00	1.0	20667	0.0016	1.00	0.68	0.057	0.00
Lead, Total	2.E-04	2.E-05	1.13	11.3	0.000267	0.0005	1	0.534	0.82			0.82	1.0	0.30	0.46	1.0	180	0.0016	0 54	0.0028	0.057	0.00030
Manganese	3 E-07	NB	977	NA	0.000246	0.0005	1	0.491	0.0000				1.0	0.30	0.00	1.0	303	0.0016	0.99	0.11	0 057	0.012
Mercury	8.E-05	8.E-06	0.0064	0.064	4 93E-07	0.0005	1	0.000987	0.0000				1.0	0.30	0.00	1 0	0.62	0.0016	1 0		0.057	0.0000
Molybdenum	4.E-07	4 E-08	3.50	35.3	1.46E-06	0.0005	1	0.00291	0.0000				1.0	0.30	0.00	1.0	1.7	0.0016	0.95	0.0028	0.057	0 054
Nickel, Total	6.E-06	4.E-06	77.40	107	0.000461	0.0005	1	0.923	1.9			1.9	1.0	0.30	0.62	1.0	220	0.0016	0.38	0.014	0.057	0.00
Silver	NB	NB	NA	NA	0	0.0005	1		0.0000				1.0	0.30	0.00	1.0		0.0016	0.00		0.057	0.0000
Zinc, Total	4.E-04	4.E-05	14.5	131	0.00512	0.0005	1	10.2	23			23	1.0	0.30	0.67	1.0	2083	0.0016	0.33	0.039	0.057	0.00022
Total PCBs	3.E-07	3.E-08	0.2	1.8	6E-08	0.0005	1	0.00012	0.0000				1.0	0.30	0.00	1.0	0.075	0.0016	1.0		0.057	0.0000
Total DDT	9.E-06	9.E-07	0.0028	0.028	2.4E-08	0.0005	1	0.000048	0.0000				1.0	0.30	0.00	1.0	0.030	0.0016	1.0		0.057	0.0000
Aldrin	NB	NB	NA	NA	1.25E-07	0.0005	1	0.000250	0.00081			0.00081	1.0	0.30	0.97	1.0	0.0041	0.0016	0.026		0.057	0.0000
Alpha Chlordane	1.E-09	3.E-10	2.14	10.7	2.86E-09	0.0005	1	5.73E-06	0.0000				1.0	0.30	0.00	1.0	0.0036	0.0016	1.0		0.057	0.0000
delta-BHC	5.E-10	1.E-10	0.56	2.25	2.72E-10	0.0005	1	5.44E-07	0.0000				1.0	0.30	0.00	1.0	0.00034	0.0016	1.0		0.057	0.0000
Dieldrin	1.E-07	NB	0.077	NA	7.41E-09	0.0005	1	1.48E-05	0.0000				1.0	0.30	0.00	1.0	0.0093	0.0016	1.0		0.057	0.0000
Endosulfan I	2.E-10	NB	10	NA	2.37E-09	0.0005	1	4.75E-06	0.0000				1.0	0.30	0.00	1.0	0.0030	0.0016	1.0		0.057	0.0000
Endosulfan II	4 E-10	NB	10	NA	4.11E-09	0.0005	1	8.21E-06	0.0000				1.0	0.30	0.00	1.0	0.0051	0.0016	1.0		0.057	0 0000
Endosulfan sulfate	2 E-10	NB	10	NA	2.24E-09	0.0005	1	4 48E-06	0.0000				1.0	0.30	0 00	1.0	0 0028	0.0016	1.0		0.057	0.0000
Endrin aldehyde	7.E-07	7 E-08	0.01	0.1	7.09E-09	0.0005	1	1.42E-05	0.0000				1.0	0 30	0.00	1.0	0 0089	0.0016	1 0		0.057	0.0000
Endrin ketone	6.E-07	6 E-08	0.01	0.1	5.6E-09	0.0005	1	0.0000112	0.0000				1.0	0.30	0.00	1.0	0.0070	0 0016	1.0		0 057	0.0000
Gamma Chlordane	2.E-07	4.E-08	2.14	10.7	4.72E-07	0.0005	1	0 000944	0.0031			0.0031	1.0	0.30	0.98	1 0	0.0090	0.0016	0.015		0.057	0.0000
gamma-BHC (Lindane)	0.E+00	0.E+00	2.0	20	0	0.0005	1	0	0.0000				1.0	0.30	0.00	1.0		0.0016	0 00		0.057	0.0000
Heptachlor	NB	NB	NA	NA	2.78E-07	0.0005	1	0.000556	0.0019			0.0019	1 0	0.30	1.0	1 0	0.00093	0.0016	0.00		0.057	0.0000
Heptachlor epoxide	NB	NB	NA	NA	3.98E-09	0.0005	1	7.95E-06	0 0000				1.0	0.30	0.00	1.0	0.0050	0.0016	1.0		0.057	0 0000
Methoxychlor	NB	NB	NA	NA	1 21E-08	0 0005	1	2 42E-05	0.0000				1.0	0.30	0.00	1.0	0 015	0.0016	1 0		0.057	0 0000
Total PAHs	2.E-06	2.E-07	40.0	400	6.91E-05	0.0005	1	0.138	0 46			0.46	1.0	0.30	1.0	1.0	0.13	0 0016	0.00	0.00070	0.057	0.00029
bis(2-ethylhexyl)phthalate	0	NB	1.1	NA	0	0.0005	1	0	0.0000				1.0	0.30	0 00	1.0		0.0016	0.00		0.057	0 0000
Di-n-butylphthalate	0	0	0.1	1.1	0	0.0005	1	0	0.0000				1.0	0 30	0.00	1.0		0.0016	0.00		0 057	0 0000
Diethylphthalate	NB	NB	NA	NA	0	0.0005	1	0	0.0000				1.0	0.30	0.00	1.0		0.0016	0.00		0.057	0 0000
Dioxin - TEQ	1.E-05	1.E-06	0.000014	0.00014	1.57E-10	0.0005	1	3.14E-07	0.0000			8.5E-08	1.0	0.30	0.081	1.0	0.00018	0.0016	0 92	3.6E-09	0.057	0 00065

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1

Food Chain Model Components:
Hazard Index Estimate = [Food Dose] + [Sediment Dose] + [Drinking Water Dose]
Toxicological Benchmark

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the soil component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%; plant moisture=70%) and then calculate a soil ingestion rate from the soil proportion in the diet (dry weight) estimated in Beyer et al. (1994)

Appendix F
Food Chain Model For
Mallard Duck Ingesting Plants in Dead Creek Section F - Maximum Concentrations
Sauget Area I

									Food[1]							Sediment[2]				Water[3]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Dose mg/kg/day	Ratio of Site to Forage Area	Ratio of Time on Site	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Invertebrate Tissue mg/kg	Proportion Inverts In Diet	Plant Concentration mg/kg	Proportion Plant In Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	NB	NB	NA	NA	0.0000368	1	1	0 0000368	0.0				1.0	0.30	0.00	1.0	0.023	0.0016	1.0		0.057	0.000
Dicamba	NB	NB	NA	NA	0	1	1	0	0.0				1.0	0.30	0.00	1.0		0.0016	0.00		0.057	0.000
Dichloroprop	NB	NB	NA	NA	0.0021	1	1	0.0021	0.0			0 0070	1.0	0.30	1.0	1.0		0.0016	0 00		0.057	0.000
MCPA	NB	NB	NA	NA	0	1	1	0	0.0				1 0	0.30	0.00	1.0		0.0016	0.00		0.057	0 000
MCPP	NB	NB	NA	NA	0	1	1	0	0.0				1.0	0.30	0.00	1.0		0 0016	0 00		0 057	0.000
Aluminum, Total	4 E-01	NB	109.7	NA	40.4	1	1	40.4	44			44	1.0	0.30	0.33	1.0	17000	0 0016	0.67	0.55	0.057	0.00077
Antimony	NB	NB	NA	NA	0.0465	1	1	0 0465	0.13			0.13	1.0	0.30	0 84	1.0	4.7	0.0016	0.16		0.057	
Arsenic, Total	4.E-02	2.E-02	5.1	12.84	0.199	1	1	0.199	0.56			0.56	1.0	0 30	0.85	1 0	19	0.0016	0.15	0.0049	0.057	0.0014
Barium, Total	*2.E-02*	*1.E-02*	*20.8*	*41.7*	*0.439*	*1*	*1*	*0.439*	*0.0*				1 0	0.30	0.00	1.0	270	0.0016	0 98	0.13	0.057	0.017
Cadmium, Total	7.E-02	5.E-03	1.45	20	0.104	1	1	0.104	0 10			0 097	1.0	0.30	0.28	1.0	47	0 0016	0.72		0.057	0.000000
Chromium, Total	6.E-02	1.E-02	1.00	5.00	0.0608	1	1	0.0608	0.0				1.0	0.30	0.00	1.0	38	0.0016	1.0		0.057	0.000
Copper, Total	3.E-02	2.E-02	47.0	61.7	1.29	1	1	1.29	2.1			2.1	1.0	0.30	0.49	1.0	410	0.0016	0.51	0.012	0 057	0.00053
Iron	NB	NB	NA	NA	41.7	1	1	41.7	0.0				1.0	0 30	0.00	1.0	26000	0.0016	1.0	1	0.057	0.00
Lead, Total	8.E-01	8 E-02	1 13	11.3	0.872	1	1	0.872	1.2			1.2	1.0	0.30	0 41	1.0	320	0.0016	0.59	0.0037	0.057	0.00024
Manganese	8.E-04	NB	977	NA	0.824	1	1	0.824	0.0				1.0	0.30	0.00	1 0	510	0.0016	0.99	0.14	0.057	0.0096
Mercury	3.E-01	3.E-02	0.0064	0.064	0.00176	1	1	0.00176	0.0				1.0	0.30	0.00	1.0	1.1	0.0016	1.0		0.057	0.0000
Molybdenum	2.E-03	2.E-04	3.50	35.3	0.00608	1	1	0.00608	0.0				1.0	0.30	0.00	1.0	3.7	0.0016	0.97	0.0028	0.057	0.026
Nickel, Total	2.E-02	1.E-02	77.40	107	1.41	1	1	1.41	2.6			2.6	1.0	0.30	0.56	1.0	390	0.0016	0.44	0.021	0 057	0.00
Silver	NB	NB	NA	NA	0	1	1		0.0				1.0	0.30	0.00	1.0		0.0016	0 00		0.057	0.0000
Zinc, Total	1	1.E-01	14.5	131	13.7	1	1	13.7	26			26	1.0	0.30	0.57	1.0	3700	0.0016	0.43	0.075	0.057	0.00031
Total PCBs	1.E-03	1.E-04	0 2	1.8	0.000192	1	1	0.000192	0.0				1.0	0.30	0.00	1.0	0.12	0.0016	1.0		0.057	0.0000
Total DDT	2.E-02	2.E-03	0 0028	0.028	0 0000688	1	1	0.0000688	0.0				1.0	0.30	0.00	1.0	0.043	0.0016	1 0		0.057	0.0000
Aldrin	NB	NB	NA	NA	0.000250	1	1	0.000250	0.0			0.00081	1.0	0.30	0.97	1.0	0.0041	0 0016	0.026		0.057	0.0000
Alpha Chlordane	4.E-06	8.E-07	2.14	10.7	8.48E-06	1	1	8.48E-06	0.0				1.0	0.30	0.00	1.0	0.0053	0.0016	1.0		0.057	0.0000
delta-BHC	1.E-06	2.E-07	0.56	2.25	5.44E-07	1	1	5.44E-07	0.0				1.0	0.30	0.00	1.0	0.00034	0.0016	1.0		0.057	0.0000
Dieldrin	2.E-04	NB	0 077	NA	1.49E-05	1	1	1.49E-05	0.0				1.0	0.30	0.00	1.0	0.0093	0.0016	1.0		0.057	0.0000
Endosulfan I	9.E-07	NB	10	NA	9.12E-06	1	1	9.12E-06	0.0				1.0	0.30	0.00	1.0	0.0057	0.0016	1 0		0.057	0.0000
Endosulfan II	1 E-06	NB	10	NA	1.30E-05	1	1	1.30E-05	0.0				*1.0*	*0.30*	*0.00*	*1.0*	*0.0081*	*0.0016*	*1.0*		*0.057*	*0.0000*
Endosulfan sulfate	4.E-07	NB	10	NA	4.48E-06	1	1	4.48E-06	0.0				1.0	0 30	0.00	1.0	0.0028	0.0016	1.0		0.057	0.0000
Endrin aldehyde	2.E-03	2.E-04	0.01	0.1	0.0000224	1	1	0.0000224	0.0				1.0	0.30	0 00	1.0	0.014	0.0016	1.0		0.057	0.0000
Endrin ketone	2.E-03	2.E-04	0.01	0.1	0.000016	1	1	0.000016	0.0				1.0	0.30	0.00	1 0	0.010	0 0016	1.0		0 057	0.0000
Gamma Chlordane	4.E-04	9.E-05	2.14	10.7	0.000957	1	1	0.000957	0.0			0 0031	1.0	0.30	0.97	1.0	0.017	0.0016	0.028		0.057	0.0000
gamma-BHC (Lindane)	0	0.E+00	2.0	20	0	1	1	0	0.0				1 0	0.30	0.00	1.0		0.0016	0.00		0 057	0.0000
Heptachlor	NB	NB	NA	NA	0.000571	1	1	0.000571	0.0			0.0019	1 0	0.30	1.0	1.0	0.00093	0.0016	0.00		0.057	0.0000
Heptachlor epoxide	NB	NB	NA	NA	8.64E-06	1	1	8 64E-06	0.0				1.0	0.30	0.00	1.0	0.0054	0.0016	1.0		0.057	0.0000
Methoxychlor	NB	NB	NA	NA	0.0000384	1	1	0.0000384	0.0				1.0	0.30	0.00	1.0	0.024	0.0016	1.0		0.057	0.0000
Total PAHs	5.E-03	5.E-04	40.0	400	0.198	1	1	0.198	0.7			0.66	1.0	0.30	1.0	1.0	0.13	0.0016	0.00	0.00070	0.057	0.00020
bis(2-ethylhexyl)phthalate	0	NB	1.1	NA	0	1	1	0	0.0				1.0	0.30	0.00	1.0		0.0016	0.00		0.057	0.0000
Di-n-butylphthalate	0	0.E+00	0 1	1.1	0	1	1	0	0.0				1.0	0.30	0 00	1.0		0.0016	0.00		0.057	0.0000
Diethylphthalate	NB	NB	NA	NA	0	1	1	0	0.0				1.0	0.30	0.00	1.0		0.0016	0.00		0.057	0.0000
Dioxin - TEQ	3.E-02	3.E-03	0.000014	0.00014	4.67E-07	1	1	4.67E-07	0 0			9.7E-08	1.0	0.30	0.063	1.0	0.00027	0.0016	0.94	9.4E-09	0.057	0.0011

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1

Food Chain Model Components:

$$\text{Hazard Index Estimate} = \frac{[\text{Food Dose}] + [\text{Sediment Dose}] + [\text{Drinking Water Dose}]}{\text{Toxicological Benchmark}}$$

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the soil component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%; plant moisture=70%) and then calculate a soil ingestion rate from the soil proportion in the diet (dry weight) estimated in Beyer et al. (1994)

Appendix F
Food Chain Model For
Mallard Duck Ingesting Shrimp from the Borrow Pit Lake - Average Concentrations
Sauget Area I

									Food[1]							Sediment[2]				Water[3]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Dose mg/kg/day	Ratio of Site to Forage Area	Time on Site Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Invertebrate Tissue mg/kg	Proportion Inverts in Diet	Plant Concentration mg/kg	Proportion Plant in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	NB	NB	NA	NA	1.36E-07	0.008	1	1.70E-05			1.0			0 40	0 00	1.0	0.0106	0 0016	1 0		0.057	0.000
Dicamba	NB	NB	NA	NA	3.605E-07	0.008	1	4.51E-05			1.0			0.40	0.00	1.0	0.028	0.0016	0.00		0 057	0.000
Dichloroprop	NB	NB	NA	NA	1.813E-06	0.008	1	2.27E-04			1.0			0.40	0.00	1.0	0.14	0.0016	0 00		0.057	0 000
MCPA	NB	NB	NA	NA	3.605E-05	0.008	1	4.51E-03			1.0			0.40	0.00	1.0	2 8	0.0016	0 00		0.057	0.000
MCPP	NB	NB	NA	NA	3.605E-05	0.008	1	4 51E-03			1.0			0.40	0 00	1.0	2.8	0.0016	0 00		0.057	0.000
Aluminum, Total	2.E-03	NB	109.7	NA	0.265	0.008	1	3.32E+01	28	28	1.0			0.40	0 34	1.0	13667	0.0016	0.66	1.6	0.057	0.0027
Antimony	NB	NB	NA	NA	0 000540	0.008	1	6.75E-02	0.16	0.16	1.0			0.40	0 95	1.0	2.2	0.0016	0.053		0.057	
Arsenic, Total	4.E-05	2.E-05	5 1	12.84	0 000206	0.008	1	2.57E-02			1.0			0 40	0.00	1.0	16	0.0016	0.97	0.012	0 057	0.026
Barium, Total	2.E-04	1.E-04	20.8	41.7	0.00455	0.008	1	5.69E-01			1.0			0.40	0.00	1.0	350	0.0016	0.98	0.16	0.057	0.016
Cadmium, Total	2.E-05	1.E-06	1 45	20	2 69E-05	0.008	1	3.36E-03			1 0			0.40	0.00	1.0	2.1	0.0016	1.0		0.057	0.000000
Chromium, Total	1.E-03	2.E-04	1.00	5.00	0.001015	0.008	1	1.27E-01	0.23	0.23	1.0			0.40	0.72	1.0	22	0.0016	0.27	0.0041	0.057	0.0018
Copper, Total	6.E-04	4.E-04	47.0	61.7	0.0272	0.008	1	3.40E+00	8.3	8.3	1.0			0.40	0 98	1.0	49	0.0016	0 023	0.0053	0.057	0 000
Iron	NB	NB	NA	NA	0.437	0.008	1	5.46E+01			1.0			0 40	0.00	1.0	34,000	0.0016	1.0	3.9	0.057	0.00
Lead, Total	2.E-03	2.E-04	1.13	11.3	0.00187	0.008	1	2.33E-01	0.39	0.39	1.0			0.40	0.67	1.0	48	0.0016	0.33	0 0083	0.057	0.0020
Manganese	2.E-05	NB	977	NA	0.0158	0 008	1	1.98E+00			1 0			0.40	0.00	1.0	1,213	0.0016	0.98	0.67	0 057	0.019
Mercury	2.E-04	2.E-05	0.0064	0.064	1.58E-06	0.008	1	1.97E-04			1.0			0.40	0.00	1 0	0.12	0.0016	1.0		0.057	0.0000
Molybdenum	3.E-06	3.E-07	3.50	35.3	9.45E-06	0.008	1	1.18E-03			1 0			0.40	0.00	1.0	0.60	0.0016	0.81	0.0040	0.057	0.19
Nickel, Total	8.E-06	6 E-06	77.40	107	0.000611	0.008	1	7.64E-02			1.0			0.40	0.00	1.0	47	0.0016	0.99	0.012	0.057	0.0086
Silver	NB	NB	NA	NA	0.0003027	0.008	1	3.78E-02	0.090	0.090	1.0			0.40	0.00	1.0	1.1	0.0016	0.00		0.057	0.0000
Zinc, Total	4.E-03	4.E-04	14.5	131	0.0552	0.008	1	6.90E+00	16	16	1.0			0.40	0.93	1.0	310	0.0016	0.072	0.031	0.057	0.00025
Total PCBs	1.E-06	1.E-07	0 2	1.8	2.048E-07	0.008	1	2.56E-05			1.0			0.40	0.00	1.0	0.016	0.0016	0.00		0.057	0.0000
Total DDT	4.E-05	4.E-06	0.0028	0.028	1.16E-07	0.008	1	1.45E-05			1.0			0.40	0.00	1.0	0.0091	0.0016	1.0		0.057	0.0000
Aldrin	NB	NB	NA	NA	5.632E-08	0.008	1	7.04E-06			1.0			0.40	0.00	1.0	0.0044	0.0016	0.00		0.057	0.0000
Alpha Chlordane	1.E-08	2.E-09	2.14	10.7	2.08E-08	0.008	1	2.60E-06			1.0			0.40	0.00	1.0	0.0016	0.0016	1.0		0.057	0.0000
delta-BHC	3.E-08	8.E-09	0.56	2.25	1.76E-08	0.008	1	2.20E-06			1.0			0.40	0.00	1.0	0.0013	0.0016	0.94	2.2E-06	0.057	0.056
Dieldrin	5.E-07	NB	0.077	NA	4.21E-08	0.008	1	5.26E-06			1.0			0.40	0.00	1.0	0.0033	0.0016	0.99	0.0000010	0.057	0.011
Endosulfan I	4.E-09	NB	10	NA	3.82E-08	0.008	1	4.78E-06			1 0			0.40	0.00	1.0	0.0029	0.0016	0.97	2.4E-06	0.057	0.028
Endosulfan II	1.E-08	NB	10	NA	1.088E-07	0.008	1	1.36E-05			1 0			0.40	0.00	1.0	0.0085	0.0016	0.00		0 057	0.0000
Endosulfan sulfate	9.E-09	NB	10	NA	8.64E-08	0.008	1	1.08E-05			1.0			0.40	0 00	1.0	0.0066	0.0016	0.98	3.2E-06	0.057	0 017
Endrin aldehyde	2.E-06	2.E-07	0.01	0.1	2.19E-08	0.008	1	2.74E-06			1.0			0.40	0 00	1.0	0.0016	0.0016	0.93	3.2E-06	0.057	0.066
Endrin ketone	8 E-06	8.E-07	0.01	0.1	8.32E-08	0 008	1	1.04E-05			1 0			0.40	0.00	1 0	0 0064	0.0016	0.99	2 7E-06	0 057	0 015
Gamma Chlordane	2.E-08	3.E-09	2.14	10.7	3.60E-08	0.008	1	4 50E-06			1.0			0.40	0.00	1.0	0.0028	0 0016	1.0		0 057	0.0000
gamma-BHC (Lindane)	3.E-08	3.E-09	2 0	20	6 337E-08	0.008	1	7.92E-06			1.0			0 40	0.00	1.0	0 0048	0.0016	0.97	3.8E-06	0.057	0 027
Heptachlor	NB	NB	NA	NA	5.748E-08	0.008	1	7.19E-06			1.0			0 40	0.00	1 0	0.0044	0.0016	0.98	2.6E-06	0.057	0.020
Heptachlor epoxide	NB	NB	NA	NA	6 21E-08	0.008	1	7.76E-06			1.0			0 40	0.00	1.0	0.0048	0.0016	0.99	9.6E-07	0 057	0 0070
Methoxychlor	NB	NB	NA	NA	5.632E-07	0 008	1	7 04E-05			1 0			0.40	0.00	1 0	0.044	0.0016	0.00		0 057	0 0000
Total PAHs	8.E-08	8.E-09	40.0	400	3.072E-06	0.008	1	3 84E-04			1 0			0.40	0 00	1.0	0.24	0 0016	0.00		0 057	0.0000
bis(2-ethylhexyl)phthalate	3.E-06	NB	1 1	NA	3 072E-06	0.008	1	3.84E-04			1.0			0.40	0 00	1.0	0.24	0.0016	0.00		0.057	0 0000
Di-n-butylphthalate	3 E-05	3.E-06	0.1	1.1	3.072E-06	0.008	1	3.84E-04			1.0			0.40	0.00	1.0	0.24	0.0016	0.00		0.057	0 0000
Diethylphthalate	NB	NB	NA	NA	0.000144	0.008	1	1.80E-02	0.044	0.044	1.0			0.40	0.98	1.0	0.24	0.0016	0.021		0 057	0 0000
Dioxin - TEQ	4.E-04	4.E-05	0.000014	0.00014	5.85E-09	0.008	1	7.31E-07	1.72E-06	1.72E-06	1.0			0.40	0.94	1.0	2.7E-05	0.0016	0.059	3.3E-10	0.057	0 0000

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1

Food Chain Model Components:
Hazard Index Estimate = [Food Dose] + [Sediment Dose] + [Drinking Water Dose]
Toxicological Benchmark

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the soil component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%, plant moisture=70%) and then calculate a soil ingestion rate from the soil proportion in the diet (dry weight) estimated in Beyer et al. (1994)

Appendix F
Food Chain Model For
Mallard Duck Ingesting Shrimp from the Borrow Pit Lake - Maximum Concentrations
Sauget Area I

									Food[1]							Sediment[2]				Water[3]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Dose mg/kg/day	Ratio of Forage Area to Site	Time on Site Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Invertebrate Tissue mg/kg	Proportion Inverts In Diet	Plant Concentration mg/kg	Proportion Plant In Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	NB	NB	NA	NA	0.0000176	1	1	0.0000176	0.0		1.0			0.40	0.00	1.0	0 011	0.0016	1.00		0.057	0.000
Dicamba	NB	NB	NA	NA	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0	0.0016	0.00		0.057	0.000
Dichloroprop	NB	NB	NA	NA	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0	0.0016	0 00		0.057	0.000
MCPA	NB	NB	NA	NA	0	1	1	0	0.0		1.0			0 40	0 00	1.0	0	0.0016	0 00		0.057	0.000
MCPP	NB	NB	NA	NA	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0	0.0016	0.00		0.057	0.000
Aluminum, Total	3.E-01	NB	109.7	NA	37.0	1	1	37.0	28	28	1.0			0.40	0.30	1.0	16000	0.0016	0.69	3.4	0.057	0 0052
Antimony	NB	NB	NA	NA	0.0675	1	1	0.0675	0.16	0.16	1.0			0.40	0.95	1.0	2 2	0.0016	0 052		0.057	
Arsenic, Total	5.E-03	2.E-03	5.1	12.84	0.0280	1	1	0.0280	0.0		1.0			0.40	0.00	1.0	17	0.0016	0 97	0.015	0.057	0.030
Barium, Total	3.E-02	2.E-02	20.8	41.7	0.690	1	1	0.690	0.0		1.0			0.40	0.00	1.0	420	0.0016	0 97	0.32	0.057	0.026
Cadmium, Total	3 E-03	2.E-04	1.45	20	0.00432	1	1	0 00432	0.0		1 0			0.40	0.00	1.0	2.7	0.0016	1.0		0.057	0.000000
Chromium, Total	1.E-01	3.E-02	1.00	5.00	0.134	1	1	0.134	0.23	0.23	1.0			0.40	0.69	1.0	26	0.0016	0.31	0.0041	0.057	0.0017
Copper, Total	7.E-02	6.E-02	47.0	61.7	3.42	1	1	3.42	8.3	8.3	1.0			0.40	0.97	1.0	64	0.0016	0.030	0.0074	0.057	0.000
Iron	NB	NB	NA	NA	61.3	1	1	61.3	0.0		1.0			*0.40*	*0.00*	*1.0*	*38000*	*0 0016*	*0.99*	6.7	0.057	0.008
Lead, Total	2.E-01	2.E-02	1.13	11.3	0.250	1	1	0.250	0.39	0 39	1.0			0 40	0.62	1.0	58	0.0016	0.37	0.020	0.057	0.0045
Manganese	2.E-03	NB	977	NA	2.34	1	1	2.34	0.0		1 0			0 40	0 00	1.0	1400	0.0016	0.96	1.7	0.057	0.041
Mercury	4.E-02	4.E-03	0.0064	0.064	0.000256	1	1	0.000256	0.0		1.0			0.40	0.00	1.0	0 16	0.0016	1.0		0.057	0.0000
Molybdenum	5.E-04	5.E-05	3.50	35.3	0.00170	1	1	0.00170	0.0		1.0			0.40	0.00	1.0	0.92	0.0016	0.87	0.0040	0.057	0.13
Nickel, Total	1.E-03	8.E-04	77.40	107	0.0872	1	1	0.0872	0 0		1.0			0.40	0.00	1 0	54	0.0016	0.99	0.015	0.057	0.010
Silver	NB	NB	NA	NA	0	1	1		0.090	0 090	1.0			0 40	0.00	1.0	1	0.0016	0.00		0.057	0.0000
Zinc, Total	5.E-01	5.E-02	14.5	131	6.99	1	1	6.99	16	16	1.0			0.40	0 91	1.0	370	0.0016	0.085	0 048	0.057	0.00039
Total PCBs	0.E+00	0.E+00	0 2	1.8	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0.000	0.0016	0 00		0.057	0 0000
Total DDT	1.E-02	1.E-03	0.0028	0.028	0.0000352	1	1	0.0000352	0.0		1.0			0.40	0 00	1.0	0.022	0.0016	1.0		0.057	0.0000
Aldrin	NB	NB	NA	NA	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0.0000	0.0016	0.00		0.057	0 0000
Alpha Chlordane	2.E-06	5.E-07	2.14	10.7	5.12E-06	1	1	5.12E-06	0.0		1.0			0.40	0.00	1.0	0.0032	0 0016	1.00		0.057	0.0000
delta-BHC	2 E-07	6.E-08	0.56	2.25	1.24E-07	1	1	1.24E-07	0.0		1.0			0.40	0.00	1.0	0.0000	0.0016	0.00	2.2E-06	0.057	1.0
Dieldrin	1.E-05	NB	0.077	NA	8.57E-07	1	1	8.57E-07	0.0		1.0			0.40	0.00	1.0	0 00050	0.0016	0.93	1.0E-06	0.057	0.066
Endosulfan I	8.E-07	NB	10	NA	7.98E-06	1	1	7.98E-06	0.0		1.0			0.40	0.00	1.0	0.0049	0 0016	0.98	2.4E-06	0.057	0.017
Endosulfan II	0	NB	10	NA	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0 0000	0.0016	0 00		0.057	0.0000
Endosulfan sulfate	2.E-06	NB	10	NA	1.54E-05	1	1	1.54E-05	0.0		1 0			0.40	0.00	1.0	0.0095	0.0016	0.99	3.2E-06	0.057	0.012
Endrin aldehyde	4.E-04	4.E-05	0.01	0.1	3.70E-06	1	1	3.70E-06	0.0		1.0			0.40	0 00	1.0	0.0022	0.0016	0.95	3.2E-06	0.057	0.049
Endrin ketone	1.E-04	1 E-05	0.01	0.1	1.30E-06	1	1	1.30E-06	0.0		1.0			0.40	0.00	1.0	0.00072	0.0016	0 88	2.7E-06	0.057	0.12
Gamma Chlordane	2.E-06	4 E-07	2.14	10.7	4.80E-06	1	1	4.80E-06	0.0		1.0			0.40	0.00	1.0	0.0030	0.0016	1.0		0.057	0.0000
gamma-BHC (Lindane)	4.E-06	4.E-07	2.0	20	7.89E-06	1	1	7.89E-06	0.0		1.0			0.40	0.00	1.0	0.0048	0.0016	0.97	3.8E-06	0.057	0.027
Heptachlor	NB	NB	NA	NA	1.64E-07	1	1	1.64E-07	0.0		1.0			0.40	0.00	1.0	0.0000	0.0016	0.00	2.9E-06	0.057	1.0
Heptachlor epoxide	NB	NB	NA	NA	7.73E-06	1	1	7.73E-06	0.0		1.0			0.40	0.00	1.0	0.0048	0.0016	0.99	9 6E-07	0.057	0.0070
Methoxychlor	NB	NB	NA	NA	0	1	1	0	0.0		1 0			0.40	0.00	1.0	0.0000	0.0016	0.00		0.057	0.0000
Total PAHs	0.E+00	0.E+00	40.0	400	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0.0000	0.0016	0.00		0.057	0.0000
bis(2-ethylhexyl)phthalate	0.E+00	NB	1.1	NA	0	1	1	0	0.0		1 0			0 40	0.00	1.0	0.0000	0 0016	0.00		0 057	0.0000
Di-n-butylphthalate	0.E+00	0.E+00	0.1	1.1	0	1	1	0	0.0		1.0			0.40	0.00	1.0	0.0000	0.0016	0.00		0.057	0.0000
Diethylphthalate	NB	NB	NA	NA	0 0176	1	1	0.0176	0 044	0.044	1.0			0.40	1.0	1.0	0 0000	0.0016	0.00		0.057	0.0000
Dioxin - TEQ	5.E-02	5.E-03	0.000014	0.00014	7.51E-07	1	1	7.51E-07	1.7E-06	1.7E-06	1 0			0.40	0.92	1.0	3.9E-05	0.0016	0.083	4.2E-10	0.057	0.0000

Notes:

NA=Not available/applicable

NB = Benchmark not available

Bolded values indicate a Hazard Index greater than 1

Food Chain Model Components:

Hazard Index Estimate = [Food Dose] + [Sediment Dose] + [Drinking Water Dose] / Toxicological Benchmark

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the soil component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%; plant moisture=70%) and then calculate a soil ingestion rate from the soil proportion in the diet (dry weight) estimated in Beyer et al. (1994)

Appendix F
Food Chain Model For
Great Blue Heron Ingesting Fish in the Borrow Pit Lake - Average Concentrations
Sauget Area I

									Food							Water		
Contaminant	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Time and Area Normalized Exposure Dose mg/kg/day	Site Area to Forage Area Ratio	Ratio of Time in Area	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Large Fish Tissue Concentration mg/kg wet	Proportion Large Fish In Diet	Forage Fish Concentratior mg/kg wet	Proportion Foragers in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	NB	NB	NA	NA	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Dicamba	NB	NB	NA	NA	5.11E-04	1.00	0.75	6.81E-04	0.00	0.0070	0.27	0.0026	0.73	0.18	1.0		0.045	0.00
Dichloroprop	NB	NB	NA	NA	9.01E-04	1.00	0.75	1.20E-03	0.01	0.0066	0.27	0.0067	0.73	0.18	1.0		0.045	0.00
MCPA	NB	NB	NA	NA	3.17E-01	1.00	0.75	4.23E-01	2.4	1.1	0.27	2.8	0.73	0.18	1.0		0.045	0.00
MCPP	NB	NB	NA	NA	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Aluminum, Total	4.E-02	NB	109.7	NA	4.58E+00	1.00	0.75	6.11E+00	34	16	0.27	40	0.73	0.18	0.99	1.6	0.045	0.012
Antimony	NB	NB	NA	NA	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Arsenic, Total	8.E-05	3.E-05	5.1	12.84	3.93E-04	1.00	0.75	5.24E-04	0.00		0.27		0.73	0.18	0.00	0.012	0.045	1.0
Barium, Total	3.E-04	1.E-04	20.8	41.7	5.46E-03	1.00	0.75	7.28E-03	0.00		0.27		0.73	0.18	0.00	0.16	0.045	1.0
Cadmium, Total	0.E+00	0.E+00	1.45	20	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Chromium, Total	5.E-02	1.E-02	1.00	5.00	4.84E-02	1.00	0.75	6.46E-02	0.36	0.53	0.27	0.29	0.73	0.18	1.0	0.0041	0.045	0.00
Copper, Total	3.E-03	2.E-03	47.0	61.7	1.23E-01	1.00	0.75	1.64E-01	0.91	0.69	0.27	0.99	0.73	0.18	1.0	0.0053	0.045	0.00
Iron	NB	NB	NA	NA	1.31E-01	1.00	0.75	1.74E-01	0.00		0.27		0.73	0.18	0.00	3.9	0.045	1.0
Lead, Total	4.E-02	4.E-03	1.13	11.3	4.39E-02	1.00	0.75	5.86E-02	0.32	0.24	0.27	0.36	0.73	0.18	0.99	0.0083	0.045	0.0064
Manganese	2.E-05	NB	977	NA	2.25E-02	1.00	0.75	3.00E-02	0.00		0.27		0.73	0.18	0.00	0.67	0.045	1.0
Mercury	4.E+00	4.E-01	0.0064	0.064	2.62E-02	1.00	0.75	3.49E-02	0.19	0.066	0.27	0.23	0.73	0.18	1.0		0.045	0.00
Molybdenum	4.E-05	4.E-06	3.50	35.3	1.35E-04	1.00	0.75	1.80E-04	0.00		0.27		0.73	0.18	0.00	0.0040	0.045	1.0
Nickel, Total	5.E-06	4.E-06	77.40	107	3.90E-04	1.00	0.75	5.21E-04	0.00		0.27		0.73	0.18	0.00	0.012	0.045	1.0
Silver	NB	NB	NA	NA	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Zinc, Total	2.E-01	3.E-02	14.5	131	3.59E+00	1.00	0.75	4.79E+00	27	18	0.27	30	0.73	0.18	1.0	0.031	0.045	0.00
Total PCBs	5.E-02	5.E-03	0.2	1.8	8.42E-03	1.00	0.75	1.12E-02	0.062	0.15	0.27	0.030	0.73	0.18	1.0		0.045	0.00
Total DDT	5.E-01	5.E-02	0.0028	0.028	1.34E-03	1.00	0.75	1.79E-03	0.010	0.016	0.27	0.0077	0.73	0.18	1.0		0.045	0.00
Aldrin	NB	NB	NA	NA	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Alpha Chlordane	9.E-05	2.E-05	2.14	10.7	1.98E-04	1.00	0.75	2.64E-04	0.00	0.0054	0.27		0.73	0.18	1.0		0.045	0.00
delta-BHC	1.E-07	3.E-08	0.56	2.25	7.43E-08	1.00	0.75	9.90E-08	0.00		0.27		0.73	0.18	0.00	2.2E-06	0.045	1.0
Dieldrin	4.E-07	NB	0.077	NA	3.38E-08	1.00	0.75	4.50E-08	0.00		0.27		0.73	0.18	0.00	0.000001	0.045	1.0
Endosulfan I	8.E-09	NB	10	NA	8.10E-08	1.00	0.75	1.08E-07	0.00		0.27		0.73	0.18	0.00	2.4E-06	0.045	1.0
Endosulfan II	0.E+00	NB	10	NA	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Endosulfan sulfate	1.E-08	NB	10	NA	1.08E-07	1.00	0.75	1.44E-07	0.00		0.27		0.73	0.18	0.00	3.2E-06	0.045	1.0
Endrin aldehyde	1.E-05	1.E-06	0.01	0.1	1.08E-07	1.00	0.75	1.44E-07	0.00		0.27		0.73	0.18	0.00	3.2E-06	0.045	1.0
Endrin ketone	9.E-06	9.E-07	0.01	0.1	9.11E-08	1.00	0.75	1.22E-07	0.00		0.27		0.73	0.18	0.00	2.7E-06	0.045	1.0
Gamma Chlordane	2.E-04	3.E-05	2.14	10.7	3.57E-04	1.00	0.75	4.76E-04	0.00	0.0098	0.27		0.73	0.18	1.0		0.045	0.00
gamma-BHC (Lindane)	6.E-08	6.E-09	2.0	20	1.28E-07	1.00	0.75	1.71E-07	0.00		0.27		0.73	0.18	0.00	3.8E-06	0.045	1.0
Heptachlor	NB	NB	NA	NA	1.02E-04	1.00	0.75	1.36E-04	0.00	0.0028	0.27		0.73	0.18	1.0	2.6E-06	0.045	0.00
Heptachlor epoxide	NB	NB	NA	NA	3.24E-08	1.00	0.75	4.32E-08	0.00		0.27		0.73	0.18	0.00	9.6E-07	0.045	1.0
Methoxychlor	NB	NB	NA	NA	0.00E+00	1.00	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Total PAHs	3.E-04	3.E-05	40.0	400	1.01E-02	1.00	0.75	1.34E-02	0.074		0.27	0.10	0.73	0.18	1.0		0.045	0.00
bis(2-ethylhexyl)phthalat	2.E-02	NB	1.1	NA	2.14E-02	1.00	0.75	2.85E-02	0.16	0.090	0.27	0.18	0.73	0.18	1.0		0.045	0.00
Di-n-butylphthalate	1.E-02	1.E-03	0.1	1.1	1.17E-03	1.00	0.75	1.56E-03	0.0086	0.032	0.27		0.73	0.18	1.0		0.045	0.00
Diethylphthalate	NB	NB	NA	NA	3.68E-03	1.00	0.75	4.90E-03	0.027	0.018	0.27	0.031	0.73	0.18	1.0		0.045	0.00
Dioxin - TEQ	6.E-02	6.E-03	0.000014	0.00014	8.96E-07	1.00	0.75	1.19E-06	0.00	8.5E-06	0.27	5.9E-06	0.73	0.18	1.0	3.3E-10	0.045	0.00

Notes:
NA = Not available/applicable
NB = Benchmark not available

Food Chain Model Components:

$$\text{Hazard Index Estimate} = \frac{\text{[Food Dose]} + \text{[Sediment Dose]} + \text{[Drinking Water Dose]}}{\text{Toxicological Benchmark}}$$

Appendix F
Food Chain Model For
Great Blue Heron Ingesting Fish in the Borrow Pit Lake- Average Concentrations
Sensitivity Analysis on Foraging Area
Sauget Area I

									Food							Water		
Contaminant	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Time and Area Normalized Exposure Dose mg/kg/day	Site Area to Forage Area Ratio	Ratio of Time in Area	Exposure Dose mg/kg/day	Total Conc in Food mg/kg wet	Large Fish Tissue Concentration mg/kg wet	Proportion Large Fish in Diet	Forage Fish Concentratior mg/kg wet	Proportion Foragers in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	NB	NB	NA	NA	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Dicamba	NB	NB	NA	NA	3.43E-07	0.0007	0.75	6.81E-04	0.00	0.0070	0.27	0.0026	0.73	0.18	1.0		0.045	0.00
Dichloroprop	NB	NB	NA	NA	6.05E-07	0.0007	0.75	1.20E-03	0.01	0.0066	0.27	0.0067	0.73	0.18	1.0		0.045	0.00
MCPA	NB	NB	NA	NA	2.13E-04	0.0007	0.75	4.23E-01	2.4	1.1	0.27	2.8	0.73	0.18	1.0		0.045	0.00
MCPP	NB	NB	NA	NA	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Aluminum, Total	3.E-05	NB	109.7	NA	3.07E-03	0.0007	0.75	6.11E+00	34	18	0.27	40	0.73	0.18	0.99	1 6	0.045	0.012
Antimony	NB	NB	NA	NA	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Arsenic, Total	5.E-08	2.E-08	6.1	12.84	2.64E-07	0.0007	0.75	5.24E-04	0.00		0.27		0.73	0 18	0.00	0.012	0.045	1.0
Barium, Total	2.E-07	9.E-08	20.8	41.7	3.68E-06	0.0007	0.75	7.28E-03	0.00		0.27		0.73	0.18	0.00	0.16	0.045	1.0
Cadmium, Total	0.E+00	0.E+00	1.45	20	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Chromium, Total	3.E-05	7.E-06	1.00	5.00	3.25E-05	0.0007	0.75	6.46E-02	0.36	0.53	0.27	0.29	0.73	0.18	1.0	0.0041	0.045	0.00
Copper, Total	2.E-06	1.E-06	47.0	61.7	8.27E-05	0.0007	0.75	1.64E-01	0.91	0.69	0.27	0.99	0.73	0.18	1.0	0.0053	0.045	0.00
Iron	NB	NB	NA	NA	8.76E-05	0.0007	0.75	1.74E-01	0.00		0.27		0.73	0.18	0.00	3.9	0.045	1.0
Lead, Total	3.E-05	3.E-06	1.13	11.3	2.95E-05	0.0007	0.75	5.86E-02	0.32	0.24	0.27	0.36	0.73	0.18	0.99	0.0083	0.045	0.0064
Manganese	2.E-08	NB	977	NA	1.51E-05	0.0007	0.75	3.00E-02	0.00		0.27		0.73	0.18	0.00	0.67	0.045	1.0
Mercury	3.E-03	3.E-04	0.0064	0.064	1.76E-05	0.0007	0.75	3.49E-02	0.19	0.086	0.27	0.23	0.73	0.18	1.0		0.045	0.00
Molybdenum	3.E-08	3.E-09	3.50	35.3	9.06E-08	0.0007	0.75	1.80E-04	0.00		0.27		0.73	0.18	0.00	0.0040	0.045	1.0
Nickel, Total	3.E-09	2.E-09	77.40	107	2.62E-07	0.0007	0.75	5.21E-04	0.00		0.27		0.73	0.18	0.00	0.012	0.045	1.0
Silver	NB	NB	NA	NA	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Zinc, Total	2.E-04	2.E-05	14.5	131	2.41E-03	0.0007	0.75	4.79E+00	27	18	0.27	30	0.73	0.18	1.0	0.031	0.045	0.00
Total PCBs	3.E-05	3.E-06	0.2	1.8	5.65E-06	0.0007	0.75	1.12E-02	0.062	0.15	0.27	0.030	0 73	0.18	1.0		0.045	0.00
Total DDT	3.E-04	3.E-05	0.0028	0.028	9.00E-07	0 0007	0.75	1.79E-03	0.010	0.016	0.27	0.0077	0.73	0.18	1 0		0.045	0.00
Aldrin	NB	NB	NA	NA	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Alpha Chlordane	6.E-08	1.E-08	2.14	10.7	1.33E-07	0.0007	0.75	2.64E-04	0.00	0.0054	0.27		0.73	0.18	1.0		0.045	0.00
delta-BHC	9.E-11	2.E-11	0.56	2.25	4.98E-11	0.0007	0.75	9.90E-08	0.00		0.27		0.73	0.18	0.00	2.2E-06	0.045	1.0
Dieldrin	3.E-10	NB	0.077	NA	2.27E-11	0.0007	0.75	4.50E-08	0.00		0.27		0 73	0.18	0.00	0.000001	0.045	1.0
Endosulfan I	5.E-12	NB	10	NA	5.44E-11	0.0007	0.75	1.08E-07	0.00		0.27		0 73	0.18	0.00	2.4E-06	0.045	1.0
Endosulfan II	0.E+00	NB	10	NA	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0 73	0.18	0.00		0.045	0.00
Endosulfan sulfate	7.E-12	NB	10	NA	7.25E-11	0.0007	0.75	1.44E-07	0.00		0.27		0.73	0.18	0.00	3.2E-06	0.045	1.0
Endrin aldehyde	7.E-09	7 E-10	0.01	0.1	7.25E-11	0.0007	0.75	1.44E-07	0.00		0.27		0.73	0.18	0.00	3.2E-06	0.045	1.0
Endrin ketone	6.E-09	6.E-10	0.01	0.1	6.12E-11	0.0007	0.75	1.22E-07	0.00		0.27		0.73	0.18	0.00	2.7E-06	0.045	1.0
Gamma Chlordane	1.E-07	2.E-08	2.14	10.7	2.40E-07	0.0007	0.75	4.76E-04	0.00	0.0098	0.27		0.73	0.18	1.0		0.045	0.00
gamma-BHC (Lindane)	4.E-11	4.E-12	2.0	20	8.61E-11	0.0007	0.75	1.71E-07	0.00		0.27		0.73	0.18	0.00	3.8E-06	0.045	1.0
Heptachlor	NB	NB	NA	NA	6.86E-08	0.0007	0.75	1.36E-04	0.00	0.0028	0.27		0.73	0.18	1.0	2.6E-06	0.045	0.00
Heptachlor epoxide	NB	NB	NA	NA	2.17E-11	0.0007	0.75	4.32E-08	0.00		0.27		0.73	0.18	0.00	9.6E-07	0.045	1.0
Methoxychlor	NB	NB	NA	NA	0.00E+00	0.0007	0.75	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Total PAHs	2.E-07	2.E-08	40.0	400	6.75E-06	0.0007	0.75	1.34E-02	0.074		0.27	0.10	0.73	0.18	1.0		0.045	0.00
bis(2-ethylhexyl)phthalat	1.E-05	NB	1.1	NA	1.43E-05	0.0007	0.75	2.85E-02	0.16	0.090	0.27	0.18	0.73	0.18	1.0		0.045	0.00
Di-n-butylphthalate	7.E-06	7.E-07	0.1	1.1	7.83E-07	0.0007	0.75	1.56E-03	0.0086	0.032	0 27		0.73	0.18	1.0		0.045	0.00
Diethylphthalate	NB	NB	NA	NA	2.47E-06	0.0007	0.75	4.90E-03	0.027	0.018	0.27	0.031	0.73	0.18	1.0		0.045	0.00
Dioxin - TEQ	4.E-05	4 E-06	0 000014	0.00014	6.02E-10	0.0007	0.75	1.19E-06	0.00	8.5E-06	0.27	5.9E-06	0.73	0.18	1.0	3.3E-10	0.045	0.00

Notes:
NA = Not available/applicable
NB = Benchmark not available

Food Chain Model Components:
Hazard Index Estimate = $\frac{\text{[Food Dose] + [Sediment Dose] + [Drinking Water Dose]}}{\text{Toxicologial Benchmark}}$

Appendix F
Food Chain Model For Great Blue Heron Ingesting Fish-Borrow Pit Lake-Maximum Concentrations
Saugot Area I

Contaminant	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Time and Area Normalized Exposure Dose mg/kg/day	Site Area to Forage Area Ratio	Ratio of Time in Area	Exposure Dose mg/kg/day	Food: Total Conc. in Food mg/kg wet	Food: Large Fish Tissue Concentration mg/kg wet	Food: Proportion Large Fish in Diet	Food: Forage Fish Concentration mg/kg wet	Food: Proportion Foragers in Diet	Food: Ingestion Rate kg/kg/day	Food: Proportion of Dose	Water: Conc. in Water mg/l	Water: Ingestion Rate l/kg/day	Water: Proportion of Dose
2,4-D	NB	NB	NA	NA	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Dicamba	NB	NB	NA	NA	4.34E-04	1.00	1.00	4.34E-04	0.00	0.0019	0.27	0.0026	0.73	0.18	1.0		0.045	0.00
Dichloroprop	NB	NB	NA	NA	1.20E-03	1.00	1.00	1 20E-03	0.0067	0.0066	0.27	0 0067	0.73	0.18	1.0		0.045	0.00
MCPA	NB	NB	NA	NA	5.21E-01	1.00	1.00	5.21E-01	2.9	1.8	0.27	3.3	0.73	0.18	1 0		0.045	0.00
MCPP	NB	NB	NA	NA	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0 73	0.18	0.00		0.045	0.00
Aluminum, Total	8.E-02	NB	109.7	NA	8.59E+00	1.00	1.00	8.59E+00	47	33	0.27	52	0.73	0.18	0.98	3.4	0.045	0.018
Antimony	NB	NB	NA	NA	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0.73	0.18	0 00		0.045	0.00
Arsenic, Total	1 E-04	5.E-05	5.14	12.84	6 75E-04	1.00	1.00	6.75E-04	0.00		0.27		0.73	0.18	0.00	0.015	0.045	1.0
Barium, Total	7.E-04	3.E-04	20.8	41.7	1.44E-02	1.00	1.00	1.44E-02	0.00		0.27		0.73	0.18	0.00	0.32	0.045	1.0
Cadmium, Total	0.E+00	0.E+00	1.45	20	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Chromium, Total	9.E-02	2.E-02	1.00	5.00	8.74E-02	1.00	1.00	8.74E-02	0.48	0.93	0.27	0.32	0.73	0.18	1.0	0.0041	0.045	0.00
Copper, Total	6.E-03	4.E-03	47.0	61.7	2 67E-01	1.00	1.00	2.67E-01	1.5	0.89	0.27	1.7	0.73	0.18	1.0	0.0074	0.045	0.00
Iron	NB	NB	NA	NA	3.92E-01	1.00	1.00	3.92E-01	0.00		0.27		0.73	0.18	0.00	8.7	0.045	1.0
Lead, Total	8.E-02	8.E-03	1.13	11.3	9.06E-02	1.00	1.00	9.06E-02	0.50	0.25	0.27	0.59	0.73	0.18	0.99	0.020	0.045	0.010
Manganese	8.E-05	NB	977	NA	7.65E-02	1.00	1.00	7.65E-02	0.00		0 27		0.73	0.18	0.00	1.7	0.045	1.0
Mercury	1.E+01	1.E+00	0.0064	0.064	9.15E-02	1.00	1.00	9.15E-02	0.51	0.26	0.27	0.60	0.73	0.18	1.0		0.045	0.00
Molybdenum	5.E-05	5.E-06	3.50	35.3	1.80E-04	1.00	1.00	1.80E-04	0.00		0.27		0.73	0.18	0.00	0.0040	0.045	1.0
Nickel, Total	9.E-06	6.E-06	77.40	107	6.75E-04	1.00	1.00	6.75E-04	0.00		0.27		0.73	0.18	0.00	0.015	0 045	1.0
Silver	NB	NB	NA	NA	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Zinc, Total	4.E-01	4.E-02	14.5	131	5.41E+00	1.00	1.00	5.41E+00	30	22	0.27	33	0.73	0.18	1.0	0.048	0.045	0.00
Total PCBs	1.E-01	1.E-02	0.2	1.8	2.07E-02	1.00	1.00	2.07E-02	0.11	0.32	0.27	0.039	0.73	0.18	1.0		0.045	0.00
Total DDT	1.E+00	1.E-01	0.0028	0.028	2.72E-03	1.00	1.00	2.72E-03	0.015	0.029	0.27	0.010	0.73	0.18	1.0		0.045	0.00
Aldrin	NB	NB	NA	NA	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Alpha Chlordane	3.E-04	5.E-05	2.14	10.7	5.83E-04	1.00	1.00	5.83E-04	0.00	0.012	0.27		0.73	0.18	1.0		0.045	0.00
delta-BHC	2.E-07	4.E-08	0.56	2.25	9.90E-08	1.00	1.00	9.90E-08	0.00		0.27		0.73	0.18	0.00	2.2E-06	0.045	1.0
Dieldrin	6.E-07	NB	0.077	NA	4.50E-08	1.00	1.00	4.50E-08	0.00		0.27		0.73	0.18	0.00	0.000001	0.045	1.0
Endosulfan I	1.E-08	NB	10	NA	1.08E-07	1.00	1.00	1.08E-07	0.00		0.27		0.73	0.18	0.00	2.4E-06	0.045	1.0
Endosulfan II	0.E+00	NB	10	NA	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Endosulfan sulfate	1.E-08	NB	10	NA	1.44E-07	1.00	1.00	1.44E-07	0.00		0 27		0.73	0.18	0.00	3.2E-06	0 045	1.0
Endrin aldehyde	1.E-05	1.E-06	0.01	0.1	1.44E-07	1.00	1.00	1.44E-07	0 00		0.27		0.73	0.18	0.00	3.2E-06	0 045	1.0
Endrin ketone	1.E-05	1.E-06	0.01	0.1	1.22E-07	1.00	1.00	1 22E-07	0.00		0.27		0 73	0.18	0 00	2.7E-06	0.045	1 0
Gamma Chlordane	4.E-04	9.E-05	2.14	10.7	9.23E-04	1.00	1.00	9.23E-04	0.0051	0.019	0.27		0.73	0 18	1.0		0 045	0.00
gamma-BHC (Lindane)	9.E-08	9 E-09	2	20	1.71E-07	1.00	1.00	1.71E-07	0.00		0.27		0.73	0 18	0.00	3.8E-06	0 045	1.0
Heptachlor	NB	NB	NA	NA	1.36E-04	1.00	1.00	1.36E-04	0.00	0.0028	0.27		0 73	0.18	1 0	2.9E-06	0.045	0.00
Heptachlor epoxide	NB	NB	NA	NA	4.32E-08	1.00	1.00	4.32E-08	0.00		0.27		0.73	0.18	0.00	9.6E-07	0 045	1.0
Methoxychlor	NB	NB	NA	NA	0.00E+00	1.00	1.00	0.00E+00	0.00		0.27		0.73	0.18	0.00		0.045	0.00
Total PAHs	3.E-04	3.E-05	40.0	400	1.34E-02	1.00	1.00	1.34E-02	0.074		0.27	0.10	0.73	0.18	1 0		0.045	0.00
bis(2-ethylhexyl)phthalate	3.E-02	NB	1.1	NA	3.49E-02	1.00	1.00	3.49E-02	0.19	0.097	0.27	0.23	0.73	0.18	1.0		0 045	0.00
Di-n-butylphthalate	1.E-02	1.E-03	0.11	1.1	1.56E-03	1.00	1.00	1.56E-03	0.0086	0.032	0.27		0.73	0.18	1.0		0 045	0.00
Diethylphthalate	NB	NB	NA	NA	5.74E-03	1.00	1.00	5.74E-03	0.032	0.018	0.27	0.037	0.73	0.18	1.0		0.045	0.00
Dioxin - TEQ	1.E-01	1.E-02	0.000014	0.00014	1.87E-06	1.00	1.00	1.87E-06	0.00	1.5E-05	0.27	8.5E-06	0 73	0.18	1.0	4.2E-10	0.045	0.00

Notes:
NA = Not available/applicable
NB = Benchmark not available

Food Chain Model Components:
Hazard Index Estimate = [Food Dose] + [Sediment Dose] + [Drinking Water Dose]
Toxicological Benchmark

Appendix F
Food Chain Model For
Muskrat Ingestion of Plants in Dead Creek Section F - Average Concentrations
Sauget Area I

									Food					Sediment				Water		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Time and Area Normalized Exposure Dose mg/kg/day	Ratio of Time on Site	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Plant Concentration mg/kg wet	Proportion Plant in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg dry	Dry Sediment Ing Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	6.E-05	1.E-05	0.72	3.6	4.60E-05	1	1	4.60E-05	0		1.0	0.34	0	1.0	0 023	0.0020	1.0		0 98	0
Dicamba	0.E+00	0.E+00	0.3	1	0.00E+00	1	1	0.00E+00	0		1.0	0 34	0	1.0		0.0020	0		0.98	0
Dichloroprop	Bench NA	Bench NA	NA	NA	2.38E-03	1	1	2.38E-03	0.0070	0.0070	1 0	0.34	1.0	1.0		0.0020	0		0.98	0
MCPA	0.E+00	0.E+00	5.4	16	0.00E+00	1	1	0.00E+00	0		1.0	0.34	0	1.0		0.0020	0		0 98	0
MCPP	0.E+00	0 E+00	2.2	6.5	0.00E+00	1	1	0.00E+00	0		1.0	0.34	0	1.0		0.0020	0		0.98	0
Aluminum, Total	5.E+01	5.E+00	0.756	7.56	3.87E+01	1	1	3.87E+01	37	37	1.0	0.34	0.33	1.0	12933	0.0020	0.67	0.25	0.98	0.0062
Antimony	9.E-01	9.E-02	0.049	0.49	4.56E-02	1	1	4.56E-02	0.12	0.12	1.0	0.34	0.86	1.0	3.3	0.0020	0 14		0.98	0
Arsenic, Total	1.E-01	Bench NA	1.8	NA	1.99E-01	1	1	1.99E-01	0.49	0.49	1.0	0.34	0.84	1.0	14	0.0020	0.14	0.0044	0.98	0.022
Barium, Total	5.E-02	4.E-02	10.5	15.1	5.71E-01	1	1	5.71E-01	0		1.0	0 34	0	1 0	223	0.0020	0.78	0 13	0 98	0.22
Cadmium, Total	1.E-01	1.E-02	0.7	7	7.86E-02	1	1	7.86E-02	0.097	0.097	1.0	0.34	0.42	1.0	23	0.0020	0.58		0.98	0
Chromium, Total	3.E-05	Bench NA	1982	NA	5.80E-02	1	1	5.80E-02	0		1.0	0.34	0	1.0	29	0.0020	1.0		0.98	0
Copper, Total	1.E-01	9.E-02	11	14.3	1.23E+00	1	1	1.23E+00	2	2	1 0	0.34	0 56	1.0	270	0 0020	0.44	0 0052	0.98	0 0042
Iron	Bench NA	Bench NA	NA	NA	4.20E+01	1	1	4.20E+01	0		1.0	0.34	0	1.0	20667	0.0020	0.98	0.68	0.98	0.016
Lead, Total	1.E-01	1.E-02	5.8	58	6.42E-01	1	1	6.42E-01	0.82	0.82	1.0	0 34	0.43	1.0	180	0.0020	0.56	0.0028	0.98	0.0043
Manganese	1.E-02	3.E-03	64	206	7.12E-01	1	1	7.12E-01	0		1.0	0.34	0	1.0	303	0.0020	0.85	0.11	0.98	0.15
Mercury	5.E-02	1.E-02	0.023	0.12	1.23E-03	1	1	1.23E-03	0		1.0	0.34	0	1.0	0.62	0.0020	1.0		0.98	0
Molybdenum	6.E-02	6.E-03	0.1	1	6.18E-03	1	1	6.18E-03	0		1.0	0.34	0	1.0	1.7	0.0020	0.56	0.0028	0.98	0.44
Nickel, Total	4.E-02	2.E-02	29	58	1.10E+00	1	1	1 10E+00	1.9	1.9	1.0	0.34	0.59	1.0	220	0.0020	0.40	0.014	0.98	0 012
Silver	0.E+00	0.E+00	15.9	161	0.00E+00	1	1	0.00E+00	0		1.0	0.34	0	1.0		0.0020	0		0.98	0
Zinc, Total	1.E-01	5.E-02	116	232	1.20E+01	1	1	1.20E+01	23	23	1.0	0.34	0 65	1.0	2083	0 0020	0.35	0.039	0.98	0.0031865
Total PCBs	1.E-03	6.E-04	0.132	0.26	1 50E-04	1	1	1.50E-04	0		1.0	0.34	0	1.0	0.075	0.0020	1.0		0.98	0
Total DDT	1.E-04	2.E-05	0.6	3	6.00E-05	1	1	6.00E-05	0		1 0	0.34	0	1.0	0.030	0.0020	1.0		0 98	0
Aldrin	2.E-03	4.E-04	0.14	0.72	2.84E-04	1	1	2.84E-04	0.00081	0.00081	1.0	0.34	0.97	1.0	0.0041	0.0020	0.029		0.98	0
Alpha Chlordane	4.E-06	2.E-06	1.8	3.6	7.16E-06	1	1	7.16E-06	0		1.0	0.34	0	1.0	0.0036	0.0020	1.0		0.98	0
delta-BHC	5.E-05	5.E-06	0.013	0.13	6.80E-07	1	1	6.80E-07	0		1 0	0.34	0	1.0	0.00034	0.0020	1.0		0.98	0
Dieldrin	1.E-03	1.E-04	0.014	0.14	1.85E-05	1	1	1.85E-05	0		1.0	0.34	0	1.0	0.0093	0.0020	1.0		0.98	0
Endosulfan I	5.E-05	Bench NA	0 11	NA	5.93E-06	1	1	5.93E-06	0		1.0	0.34	0	1.0	0.0030	0.0020	1.0		0.98	0
Endosulfan II	9.E-05	Bench NA	0.11	NA	1.03E-05	1	1	1.03E-05	0		1.0	0.34	0	1 0	0.0051	0.0020	1.0		0.98	0
Endosulfan sulfate	5.E-05	Bench NA	0.11	NA	5.60E-06	1	1	5.60E-06	0		1.0	0.34	0	1.0	0.0028	0.0020	1.0		0.98	0
Endrin aldehyde	5.E-04	5.E-05	0.036	0.36	1.77E-05	1	1	1.77E-05	0		1.0	0 34	0	1.0	0.0089	0.0020	1.0		0.98	0
Endrin ketone	4.E-04	4.E-05	0.036	0.36	1 40E-05	1	1	1 40E-05	0		1.0	0.34	0	1.0	0.0070	0.0020	1.0		0.98	0
Gamma Chlordane	6.E-04	3.E-04	1.8	3.6	1.07E-03	1	1	1.07E-03	0.0031	0.0031	1 0	0.34	0.98	1.0	0.0090	0.0020	0.017		0.98	0
gamma-BHC (Lindane)	0.E+00	0 E+00	5.8	58	0.00E+00	1	1	0.00E+00	0		1.0	0.34	0	1.0		0.0020	0		0.98	0
Heptachlor	7.E-03	7.E-04	0.094	0.94	6.31E-04	1	1	6.31E-04	0.0019	0.0019	1.0	0.34	1.0	1.0	0.00093	0.0020	0.0029		0.98	0
Heptachlor epoxide	1.E-04	1.E-05	0.094	0.94	9.94E-06	1	1	9.94E-06	0		1.0	0.34	0	1.0	0.0050	0.0020	1.0		0.98	0
Methoxychlor	1.E-05	5.E-06	2.9	5.8	3.02E-05	1	1	3.02E-05	0		1.0	0.34	0	1.0	0.015	0.0020	1.0		0.98	0
bis(2-ethylhexyl)phthalat	0.E+00	0.E+00	7.17	71.7	0.00E+00	1	1	0.00E+00	0		1.0	0 34	0	1.0		0.0020	0		0.98	0
Di-n-butylphthalate	0.E+00	0.E+00	215	718	0.00E+00	1	1	0.00E+00	0		1.0	0.34	0	1.0		0.0020	0		0.98	0
Diethylphthalate	0.E+00	Bench NA	1795	NA	0.00E+00	1	1	0.00E+00	0		1.0	0 34	0	1.0		0.0020	0		0.98	0
Acenaphthylene	Bench NA	Bench NA	NA	NA	1.09E-02	1	1	1.09E-02	0.032	0.032	1.0	0.34	1.0	1.0		0.0020	0		0.98	0
Fluoranthene	5.E-06	Bench NA	196	NA	9.46E-04	1	1	9.46E-04	0		1.0	0.34	0	1.0	0.13	0.0020	0.27	0.00070	0.98	0.73
Benzo(b)fluoranthene	Bench NA	Bench NA	NA	NA	2.01E-02	1	1	2.01E-02	0.059	0.059	1.0	0.34	1.0	1.0		0.0020	0		0.98	0
Benzo(k)fluoranthene	Bench NA	Bench NA	NA	NA	1.77E-02	1	1	1.77E-02	0.052	0.052	1.0	0.34	1.0	1 0		0.0020	0		0.98	0
Benzo(a)pyrene	1.E-01	1.E-02	0.39	3.9	3.83E-02	1	1	3.83E-02	0.11	0.11	1.0	0.34	1.0	1.0		0.0020	0		0.98	0
Indeno(1,2,3-c-d)pyrene	Bench NA	Bench NA	NA	NA	6.55E-02	1	1	6.55E-02	0.19	0.19	1.0	0.34	1.0	1.0		0.0020	0		0.98	0
Dibenz(a,h)anthracene	Bench NA	Bench NA	NA	NA	2.58E-02	1	1	2.58E-02	0.076	0.076	1.0	0.34	1.0	1.0		0.0020	0		0.98	0
Dioxin - TEQ	7.E-01	7.E-02	7.2E-07	0.0000072	4.93E-07	1	1	4.93E-07	1.7E-07	1.7E-07	1.0	0.34	0.12	1.0	0.00022	0.0020	0.87	4.0E-09	0.98	0.0080

Notes:
NA=Not available/applicable
Bench NA = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Site area is larger than foraging area therefore a site area to forage area ratio of 1 is applied to the exposure dose
Food Chain Model Components:
Hazard Index Estimate = $\frac{\text{[Food Dose] + [Sediment Dose] + [Drinking Water Dose]}}{\text{Toxicological Benchmark}}$

Food and Water Ingestion Rate (EPA 1993)

**For the soil component, we convert the food ingestion rate from wet weight to dry weight (plant moisture=70%) and then calculate a soil ingestion rate from the soil proportion in the diet (dry weight) estimated in Beyer et al. (1994).

Appendix F
Food Chain Model For
Muskrat Ingestion of Plants in Dead Creek Section F - Maximum Concentrations
Sauget Area I

									Food					Sediment				Water		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Time and Area Normalized Exposure Dose mg/kg/day	Ratio of Time on Site	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Plant Concentration mg/kg wet	Proportion Plant in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg dry	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	6.E-05	2.E-05	0.72	2.6	4.60E-05	1	1	4.60E-05	0.0		1.0	0.34	0.00	1.0	0.023	0.0020	1.0		0.98	0.000
Dicamba	0.E+00	0 E+00	0.3	1	0.00E+00	1	1	0.00E+00	0.0		1.0	0.34	0.00	1.0		0.0020	0.00		0.98	0.000
Dichloroprop	Bench NA	Bench NA	NA	NA	2.38E-03	1	1	2.38E-03	0.0	0.007	1.0	0.34	1.00	1.0		0.0020	0.00		0.98	0.000
MCPA	0 E+00	0.E+00	5.4	16	0.00E+00	1	1	0.00E+00	0 0		1.0	0.34	0.00	1.0		0.0020	0.00		0.98	0.000
MCPP	0.E+00	0.E+00	2.2	6.5	0.00E+00	1	1	0.00E+00	0.0		1 0	0.34	0.00	1.0		0.0020	0.00		0.98	0.000
Aluminum, Total	7.E+01	7.E+00	0.756	7.56	4.95E+01	1	1	4.95E+01	44	44	1 0	0 34	0.30	1.0	17000	0.0020	0.69	0.55	0.98	0.011
Antimony	1.E+00	1.E-01	0.049	0.49	5.36E-02	1	1	5.36E-02	0.13	0.13	1.0	0.34	0.82	1.0	4.7	0.0020	0.18		0.98	0.000
Arsenic, Total	1.E-01	Bench NA	1.8	NA	2.33E-01	1	1	2.33E-01	0.56	0.56	1.0	0.34	0.82	1 0	19	0.0020	0.16	0.0049	0.98	0 021
Barium, Total	6.E-02	4.E-02	10.5	15.1	6.67E-01	1	1	6.67E-01	0.0		1.0	0.34	0.00	1.0	270	0.0020	0.81	0.13	0.98	0.19
Cadmium, Total	2.E-01	2.E-02	0.7	7	1.27E-01	1	1	1.27E-01	0.10	0.097	1.0	0 34	0.26	1.0	47	0.0020	0.74		0.98	0.000
Chromium, Total	4.E-05	Bench NA	1982	NA	7 60E-02	1	1	7 60E-02	0.0		1.0	0 34	0.00	1.0	38	0.0020	1.0		0.98	0.000
Copper, Total	1.E-01	1.E-01	11	14.3	1.55E+00	1	1	1.55E+00	2.1	2.1	1.0	0.34	0.46	1.0	410	0.0020	0.53	0.012	0.98	0.0076
Iron	Bench NA	Bench NA	NA	NA	5.30E+01	1	1	5.30E+01	0.0		1.0	0.34	0.00	1.0	26000	0.0020	0.98	1	0.98	0.018
Lead, Total	2.E-01	2.E-02	5.8	58	1.05E+00	1	1	1.05E+00	1.2	1.2	1.0	0.34	0.39	1.0	320	0 0020	0.61	0.0037	0.98	0 0034
Manganese	2 E-02	6.E-03	64	206	1.16E+00	1	1	1.16E+00	0.0		1.0	0 34	0.00	1.0	510	0.0020	0.88	0.14	0.98	0.12
Mercury	1.E-01	2.E-02	0.023	0.12	2.20E-03	1	1	2.20E-03	0.0		1.0	0.34	0.00	1.0	1.1	0.0020	1.0		0.98	0.000
Molybdenum	1.E-01	1.E-02	0.1	1	1.01E-02	1	1	1.01E-02	0.0		1.0	0.34	0.00	1.0	3.7	0.0020	0.73	0.0028	0.98	0.27
Nickel, Total	6.E-02	3.E-02	29	56	1.68E+00	1	1	1.68E+00	2.6	2.6	1.0	0.34	0.52	1.0	390	0.0020	0.46	0.021	0.98	0 012
Silver	0.E+00	0.E+00	15.9	161	0.00E+00	1	1	0.00E+00	0.0		1.0	0.34	0.00	1.0		0.0020	0.00		0.98	0.000
Zinc, Total	1.E-01	7.E-02	116	232	1.63E+01	1	1	1.63E+01	26	26	1.0	0.34	0.54	1.0	3700	0.0020	0.45	0.075	0.98	0.0045
Total PCBs	2.E-03	9.E-04	0.132	0.26	2.40E-04	1	1	2.40E-04	0.0		1.0	0.34	0.00	1.0	0.12	0.0020	1.0		0.98	0.000
Total DDT	1.E-04	3.E-05	0.6	3	8.60E-05	1	1	8.60E-05	0.0		1.0	0.34	0.00	1.0	0.043	0.0020	1.0		0.98	0.000
Aldrin	2.E-03	4.E-04	0.14	0.72	2.84E-04	1	1	2.84E-04	0.0	0.00061	1.0	0.34	0.97	1.0	0.0041	0.0020	0.03		0.98	0.000
Alpha Chlordane	6.E-06	3.E-06	1.8	3.6	1.06E-05	1	1	1.06E-05	0.0		1.0	0.34	0.00	1.0	0.0053	0.0020	1.0		0.98	0.000
delta-BHC	5.E-05	5.E-06	0.013	0.13	6.80E-07	1	1	6.80E-07	0.0		1.0	0.34	0.00	1.0	0.00034	0.0020	1.0		0.98	0.000
Dieldrin	1.E-03	1.E-04	0.014	0.14	1.86E-05	1	1	1.86E-05	0.0		1.0	0.34	0.00	1.0	0.0093	0.0020	1.0		0.98	0.000
Endosulfan I	1.E-04	Bench NA	0.11	NA	1.14E-05	1	1	1.14E-05	0.0		1.0	0.34	0.00	1.0	0.0057	0.0020	1.0		0.98	0.000
Endosulfan II	1.E-04	Bench NA	0.11	NA	1.62E-05	1	1	1.62E-05	0.0		1.0	0.34	0.00	1.0	0.0081	0.0020	1.0		0.98	0.000
Endosulfan sulfate	5.E-05	Bench NA	0.11	NA	5.60E-06	1	1	5 60E-06	0.0		1.0	0 34	0.00	1.0	0.0028	0.0020	1.0		0.98	0.000
Endrin aldehyde	8.E-04	8.E-05	0 036	0.36	2.80E-05	1	1	2.80E-05	0.0		1.0	0.34	0.00	1.0	0.014	0.0020	1.0		0.98	0.000
Endrin ketone	6 E-04	6.E-05	0.036	0 36	2.00E-05	1	1	2 00E-05	0.0		1.0	0.34	0.00	1.0	0.010	0.0020	1.0		0.98	0 000
Gamma Chlordane	6.E-04	3.E-04	1 8	3.6	1.09E-03	1	1	1.09E-03	0.0	0.0031	1.0	0.34	0.97	1.0	0.017	0.0020	0.031		0.98	0 000
gamma-BHC (Lindane)	0.E+00	0.E+00	5.8	58	0 00E+00	1	1	0.00E+00	0 0		1.0	0.34	0.00	1.0		0.0020	0.00		0.98	0.000
Heptachlor	7.E-03	7.E-04	0.094	0.94	6.48E-04	1	1	6.48E-04	0.0	0.0019	1 0	0.34	1.0	1.0	0.00093	0.0020	0.00		0.98	0.000
Heptachlor epoxide	1.E-04	1.E-05	0 094	0.94	1.08E-05	1	1	1.08E-05	0.0		1.0	0.34	0.00	1.0	0.0054	0.0020	1.0		0.98	0.000
Methoxychlor	2.E-05	8.E-06	2.9	5.8	4.80E-05	1	1	4.80E-05	0 0		1.0	0.34	0.00	1.0	0.024	0.0020	1.0		0.98	0.000
bis(2-ethylhexyl)phthalat	0.E+00	0.E+00	7.17	71.7	0.00E+00	1	1	0.00E+00	0.0		1.0	0.34	0.00	1.0		0.0020	0.00		0.98	0.000
Di-n-butylphthalate	0.E+00	0.E+00	215	718	0 00E+00	1	1	0.00E+00	0.0		1.0	0.34	0.00	1.0		0.0020	0.00		0.98	0
Diethylphthalate	0.E+00	Bench NA	1795	NA	0.00E+00	1	1	0.00E+00	0 0		1.0	0.34	0.00	1.0		0.0020	0.00		0.98	0.000
Acenaphthylene	Bench NA	Bench NA	NA	NA	1.09E-02	1	1	1.09E-02	0.0	0.032	1.0	0.34	1.0	1.0		0.0020	0.00		0.98	0.000
Fluoranthene	5.E-06	Bench NA	196	NA	9.46E-04	1	1	9.46E-04	0.0		1 0	0.34	0.00	1.0	0.13	0 0020	0.27	0.00070	0.98	0 73
Benzo(b)fluoranthene	Bench NA	Bench NA	NA	NA	2.01E-02	1	1	2.01E-02	0.06	0.059	1.0	0 34	1.0	1.0		0.0020	0.00		0 98	0.000
Benzo(k)fluoranthene	Bench NA	Bench NA	NA	NA	1.77E-02	1	1	1 77E-02	0.05	0.052	1.0	0.34	1.0	1.0		0.0020	0.00		0.98	0.000
Benzo(a)pyrene	1.E-01	1.E-02	0.39	3.9	4.76E-02	1	1	4.76E-02	0.14	0.14	1.0	0.34	1.0	1.0		0.0020	0.00		0 98	0.000
Indeno(1,2,3-c-d)pyrene	Bench NA	Bench NA	NA	NA	1.02E-01	1	1	1 02E-01	0.30	0.30	1.0	0.34	1.0	1.0		0.0020	0.00		0.98	0.000
Dibenz(a,h)anthracene	Bench NA	Bench NA	NA	NA	2.58E-02	1	1	2.58E-02	0.076	0.076	1 0	0.34	1.0	1.0		0.0020	0.00		0.98	0.000
Dioxin - TEQ	1.E+00	1.E-01	7.20E-07	7 20E-06	7.44E-07	1	1	7.44E-07	0.0	2.0E-07	1.0	0.34	0.092	1.0	0 00033	0.0020	0.89	1.01E-08	0.98	0.013

Notes:
NA=Not available/applicable
Bench NA = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Site area is larger than foraging area therefore a site area to forage area ratio of 1 is applied to the exposure dose
Food Chain Model Components:
Hazard Index Estimate = $\frac{\text{[Food Dose] + [Sediment Dose] + [Drinking Water Dose]}}{\text{Toxicological Benchmark}}$

Food and Water Ingestion Rate (EPA 1993).

***For the soil component, we convert the food ingestion rate from wet weight to dry weight (plant moisture=70%) and then calculate a soil ingestion rate from the* soil proportion in the diet (dry weight) estimated in Beyer et al (1994).

Appendix F
Food Chain Model For
Muskrats Ingesting Clams in the Borrow Pit Lake - Average Concentrations
Sauget Area I

									Food				Sediment					Water		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Forage Area Normalized Exposure Dose mg/kg/day	Time on Site Ratio	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Proportion Clam in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg dry	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	3.E-05	6 E-06	0.72	3.6	2 12E-05	1	1	2.12E-05		1.0	0.34	0	1.0	0.011	0.0020	1		0.98	0
Dicamba	2.E-04	6.E-05	0.3	1	5.63E-05	1	1	5.63E-05		1.0	0 34	0	1.0	0.028	0 0020	0		0.98	0
Dichloroprop	NB	NB	NA	NA	6.54E-03	1	1	6.54E-03	0.018	1.0	0.34	0.96	1.0	0.14	0.0020	0 043		0.98	0
MCPA	1.E-03	4.E-04	5.4	16	5.63E-03	1	1	5.63E-03		1.0	0.34	0	1.0	2.8	0.0020	0.0000		0.98	0
MCPP	6.E-01	2.E-01	2.2	6.5	1.37E+00	1	1	1.37E+00	4.0	1.0	0.34	1.0	1.0	2.8	0.0020	0.0041		0.98	0
Aluminum, Total	**4.E+01**	**4.E+00**	0.756	7.56	3.25E+01	1	1	3.25E+01	11	1.0	0.34	0.11	1.0	13667	0.0020	0.84	1.6	0.98	0.048
Antimony	9.E-02	9.E-03	0.049	0.49	4.43E-03	1	1	4.43E-03		1.0	0.34	0	1.0	2.2	0.0020	1.0		0.98	0
Arsenic, Total	2.E-01	NB	1.8	NA	3.69E-01	1	1	3.69E-01	0.96	1.0	0.34	0.88	1 0	16	0.0020	0.085	0.012	0.98	0.031
Barium, Total	8.E-02	6.E-02	10.5	15.1	8.58E-01	1	1	8.58E-01		1.0	0.34	0	1.0	350	0.0020	0.82	0.16	0.98	0.18
Cadmium, Total	6.E-02	6.E-03	0.7	7	4.50E-02	1	1	4.50E-02	0.12	1.0	0.34	0.91	1.0	2.1	0.0020	0.093		0.98	0
Chromium, Total	1.E-04	NB	1982	NA	2.79E-01	1	1	2.79E-01	0.68	1.0	0.34	0.83	1 0	22	0.0020	0.16	0.0041	0 98	0.014
Copper, Total	4.E-02	3.E-02	11	14.3	3.94E-01	1	1	3.94E-01	0.86	1.0	0.34	0.74	1.0	49	0.0020	0.25	0.0053	0.98	0.013
Iron	NB	NB	NA	NA	7.18E+01	1	1	7.18E+01		1.0	0.34	0	1.0	34000	0.0020	0.95	3.9	0.98	0.053
Lead, Total	3.E-02	3.E-03	5.8	58	1.83E-01	1	1	1.83E-01	0.23	1.0	0.34	0.43	1 0	48	0.0020	0.52	0.0083	0.98	0.044
Manganese	5.E-02	1.E-02	64	206	3.08E+00	1	1	3.08E+00		1 0	0.34	0	1.0	1213	0.0020	0.79	0.67	0.98	0.21
Mercury	1.E-02	2 E-03	0.023	0.12	2.47E-04	1	1	2.47E-04		1.0	0.34	0	1.0	0.12	0.0020	1 0		0.98	0
Molybdenum	5.E-02	5.E-03	0.1	1	5.11E-03	1	1	5.11E-03		1.0	0.34	0	1.0	0.60	0.0020	0.23	0.0040	0.98	0.77
Nickel, Total	4.E-03	2.E-03	29	58	1.06E-01	1	1	1.06E-01		1.0	0.34	0	1.0	47	0 0020	0.89	0.012	0.98	0.11
Silver	5.E-04	5.E-05	15.9	161	7.39E-03	1	1	7.39E-03	0.015	1 0	0.34	0.69	1.0	1.1	0.0020	0.31		0.98	0
Zinc, Total	5.E-02	2.E-02	116	232	5.74E+00	1	1	5.74E+00	15	1.0	0.34	0.89	1.0	310	0.0020	0.11	0.031	0.98	0.0052
Total PCBs	2.E-04	1.E-04	0.132	0.26	3.20E-05	1	1	3.20E-05		1.0	0.34	0	1.0	0.016	0.0020	0		0.98	0
Total DDT	3.E-05	6.E-06	0.6	3	1.81E-05	1	1	1.81E-05		1.0	0.34	0	1.0	0.0091	0.0020	1.0		0.98	0
Aldrin	6.E-05	1.E-05	0.14	0.72	8.80E-06	1	1	8.80E-06		1.0	0.34	0	1.0	0.0044	0 0020	0		0.98	0
Alpha Chlordane	2.E-06	9.E-07	1.8	3.6	3.25E-06	1	1	3.25E-06		1.0	0.34	0	1.0	0 0016	0.0020	1.0		0.98	0
delta-BHC	4.E-04	4.E-05	0.013	0.13	4.76E-06	1	1	4.76E-06		1.0	0.34	0	1.0	0.0013	0.0020	0.55	2.2E-06	0.98	0.45
Dieldrin	5.E-04	5.E-05	0.014	0.14	7.49E-06	1	1	7.49E-06		1 0	0.34	0	1.0	0.0033	0.0020	0.87	0.0000010	0.98	0.13
Endosulfan I	7.E-05	NB	0.11	NA	8.15E-06	1	1	8.15E-06		1.0	0.34	0	1.0	0.0029	0.0020	0.71	2.4E-06	0.98	0.29
Endosulfan II	2.E-04	NB	0.11	NA	1.70E-05	1	1	1.70E-05		1.0	0.34	0	1.0	0.0085	0.0020	0		0.98	0
Endosulfan sulfate	1.E-04	NB	0.11	NA	1.64E-05	1	1	1.64E-05		1.0	0.34	0	1.0	0.0066	0.0020	0.81	3.2E-06	0.98	0.19
Endrin aldehyde	2.E-04	2.E-05	0.036	0.36	6.34E-06	1	1	6.34E-06		1.0	0.34	0	1.0	0 0016	0.0020	0.51	3.2E-06	0.98	0.49
Endrin ketone	4.E-04	4.E-05	0.036	0.36	1.55E-05	1	1	1.55E-05		1.0	0.34	0	1.0	0.0064	0.0020	0.83	2.7E-06	0.98	0.17
Gamma Chlordane	3.E-06	2.E-06	1.8	3.6	5.63E-06	1	1	5.63E-06		1.0	0.34	0	1.0	0.0028	0.0020	1		0.98	0
gamma-BHC (Lindane)	2.E-06	2.E-07	5.8	58	1.34E-05	1	1	1.34E-05		1.0	0.34	0	1.0	0.0048	0.0020	0.72	3.8E-06	0.98	0.28
Heptachlor	8.E-03	8 E-04	0.094	0.94	7.93E-04	1	1	7.93E-04	0.0023	1.0	0.34	0.99	1.0	0.0044	0.0020	0.011	2.6E-06	0.98	0.0032
Heptachlor epoxide	1.E-04	1.E-05	0.094	0.94	1.06E-05	1	1	1.06E-05		1.0	0.34	0	1.0	0.0048	0.0020	0.91	9.6E-07	0.98	0.09
Methoxychlor	7.E-04	3.E-04	2.9	5.8	1.92E-03	1	1	1.92E-03	0.0054	1 0	0.34	0.95	1.0	0.044	0.0020	0.046		0.98	0
bis(2-ethylhexyl)phthalat	5.E-03	5.E-04	7 17	71.7	3.43E-02	1	1	3.43E-02	0.099	1.0	0.34	0.99	1.0	0.24	0.0020	0.014		0.98	0
Di-n-butylphthalate	2.E-06	7.E-07	215	718	4.80E-04	1	1	4.80E-04		1 0	0.34	0	1.0	0.24	0.0020	0		0.98	0
Diethylphthalate	1.E-05	NB	1795	NA	2.61E-02	1	1	2.61E-02	0.075	1.0	0.34	0.98	1.0	0.24	0.0020	0.018		0.98	0
Acenaphthylene	NB	NB	NA	NA	4.80E-04	1	1	4.80E-04		1.0	0 34	0	1.0	0.24	0.0020	0		0.98	0
Fluoranthene	2.E-06	NB	196	NA	4.80E-04	1	1	4.80E-04		1.0	0.34	0	1.0	0.24	0.0020	0		0.98	0
Benzo(b)fluoranthene	NB	NB	NA	NA	4.80E-04	1	1	4.80E-04		1.0	0.34	0	1.0	0.24	0.0020	0		0 98	0
Benzo(k)fluoranthene	NB	NB	NA	NA	4.80E-04	1	1	4.80E-04		1.0	0.34	0	1.0	0.24	0.0020	0		0.98	0
Benzo(a)pyrene	6.E-04	6.E-05	0.39	3.9	2.53E-04	1	1	2.53E-04		1.0	0.34	0	1.0	0.13	0.0020	0		0.98	0
Indeno(1,2,3-c-d)pyrene	NB	NB	NA	NA	4.80E-04	1	1	4.80E-04		1.0	0.34	0	1.0	0.24	0.0020	0		0.98	0
Dibenz(a,h)anthracene	NB	NB	NA	NA	2.53E-04	1	1	2.53E-04		1.0	0.34	0	1.0	0.13	0.0020	0		0.98	0
Dioxin - TEQ	1.E-01	1.E-02	7.2E-07	0.0000072	7.26E-08	1	1	7.26E-08	8.3E-08	1.0	0.34	0.39	1.0	2.2E-05	0.0020	0.60	7.0E-10	0.98	0.0094

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Site area is larger than foraging area therefore a site area to forage area ratio of 1 is applied to the exposure dose
Food Chain Model Components:

Hazard Index Estimate = $\frac{\text{[Food Dose] + [Sediment Dose] + [Drinking Water Dose]}}{\text{Toxicological Benchmark}}$

Food and Water Ingestion Rate (EPA 1993).

Appendix F
Food Chain Model For
Muskrats Ingesting Clams in the Borrow Pit Lake- Maximum Concentrations
Sauget Area I

Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Forage Area Normalized Exposure Dose mg/kg/day	Time on Site Ratio	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Food Total Conc. in Food mg/kg wet	Food Proportion Clam in Diet	Food Ingestion Rate kg/kg/day	Food Proportion of Dose	Sediment RAF	Sediment Conc. in Sediment mg/kg dry	Sediment Dry Sediment Ing. Rate kg/kg/day	Sediment Proportion of Dose	Water Conc. in Water mg/l	Water Ingestion Rate l/kg/day	Water Proportion of Dose
2,4-D	3.E-05	6.E-06	0.72	3.6	2.20E-05	1	1	2.20E-05		1.0	0.34	0	1.0	0.011	0.0020	1.0		0.98	0
Dicamba	0.E+00	0.E+00	0.3	1	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Dichloroprop	NB	NB	NA	NA	1.09E-02	1	1	1.09E-02	0.032	1.0	0.34	1.0	1.0	0	0 0020	0		0.98	0
MCPA	0.E+00	0.E+00	5.4	16	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
MCPP	6.E-01	2.E-01	2.2	6.5	1 36E+00	1	1	1.36E+00	4	1.0	0.34	1.0	1.0	0	0.0020	0		0.98	0
Aluminum, Total	5.E+01	5.E+00	0.756	7.56	3.98E+01	1	1	3.98E+01	13	1.0	0 34	0.11	1 0	16000	0.0020	0 80	3.4	0.98	0.084
Antimony	9.E-02	9.E-03	0.049	0.49	4.40E-03	1	1	4.40E-03		1.0	0.34	0	1.0	2.2	0.0020	1.0		0.98	0
Arsenic, Total	2.E-01	NB	1.8	NA	3.75E-01	1	1	3 75E-01	0 96	1.0	0.34	0.87	1.0	17	0.0020	0.09	0.015	0.98	0.039
Barium, Total	1.E-01	8.E-02	10.5	15.1	1.15E+00	1	1	1.15E+00		1.0	0.34	0	1 0	420	0 0020	0.73	0.32	0.98	0 27
Cadmium, Total	7.E-02	7.E-03	0.7	7	4.62E-02	1	1	4.62E-02	0.12	1.0	0.34	0.88	1.0	2.7	0.0020	0.12		0.98	0
Chromium, Total	2.E-04	NB	1982	NA	4.30E-01	1	1	4.30E-01	1.1	1.0	0.34	0.87	1.0	26	0.0020	0.12	0.0041	0.98	0.0093
Copper, Total	4.E-02	3.E-02	11	14.3	4.72E-01	1	1	4.72E-01	0.99	1.0	0.34	0.71	1.0	64	0 0020	0.27	0.0074	0.98	0.015
Iron	NB	NB	NA	NA	8.45E+01	1	1	8.45E+01		1.0	0.34	0	1.0	38000	0.0020	0.90	8.7	0.98	0.10
Lead, Total	4.E-02	4.E-03	5.8	58	2.21E-01	1	1	2.21E-01	0.25	1.0	0.34	0.39	1.0	58	0.0020	0.53	0.020	0.98	0.089
Manganese	7.E-02	2.E-02	64	206	4.47E+00	1	1	4.47E+00		1.0	0.34	0	1.0	1400	0.0020	0.63	1.7	0.98	0.37
Mercury	1.E-02	3.E-03	0.023	0.12	3.20E-04	1	1	3.20E-04		1.0	0.34	0	1.0	0.16	0.0020	1.0		0.98	0
Molybdenum	6.E-02	6.E-03	0.1	1	5.76E-03	1	1	5.76E-03		1.0	0.34	0	1.0	0.92	0.0020	0.32	0.0040	0.98	0.68
Nickel, Total	4.E-03	2.E-03	29	58	1.23E-01	1	1	1.23E-01		1.0	0.34	0	1.0	54	0.0020	0.88	0.015	0.98	0.12
Silver	4.E-04	4.E-05	15.9	161	6.68E-03	1	1	6.68E-03	0.015	1.0	0.34	0.76	1.0	0.79	0.0020	0.24		0.98	0
Zinc, Total	7.E-02	4.E-02	116	232	8.27E+00	1	1	8.27E+00	22	1.0	0.34	0.90	1.0	370	0.0020	0.09	0.048	0.98	0.0057
Total PCBs	0.E+00	0.E+00	0.132	0.26	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0.000	0.0020	0		0.98	0
Total DDT	7.E-05	1.E-05	0.6	3	4.40E-05	1	1	4.40E-05		1.0	0.34	0	1.0	0.022	0.0020	1.0E+00		0.98	0
Aldrin	0.E+00	0.E+00	0.14	0.72	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0.0000	0.0020	0		0.98	0
Alpha Chlordane	4.E-06	2.E-06	1.8	3.6	6.40E-06	1	1	6.40E-06		1.0	0.34	0	1.0	0.0032	0.0020	1		0.98	0
delta-BHC	2.E-04	2.E-05	0.013	0.13	2.16E-06	1	1	2.16E-06		1.0	0.34	0	1.0	0.0000	0.0020	0	2.2E-06	0.98	1.0
Dieldrin	1.E-04	1.E-05	0.014	0.14	1.98E-06	1	1	1.98E-06		1.0	0.34	0	1.0	0.00050	0.0020	0.51	1.0E-06	0.98	0.49
Endosulfan I	1.E-04	NB	0.11	NA	1.22E-05	1	1	1.22E-05		1.0	0.34	0	1.0	0.0049	0.0020	0.81	2.4E-06	0.98	0.19
Endosulfan II	0.E+00	NB	0.11	NA	0.00E+00	1	1	0 00E+00		1.0	0.34	0	1.0	0.0000	0.0020	0		0.98	0
Endosulfan sulfate	2.E-04	NB	0.11	NA	2.21E-05	1	1	2.21E-05		1.0	0.34	0	1.0	0.0095	0.0020	0.86	3.2E-06	0.98	0.14
Endrin aldehyde	2.E-04	2.E-05	0.036	0.36	7.54E-06	1	1	7.54E-06		1.0	0 34	0	1.0	0.0022	0.0020	0.58	3.2E-06	0.98	0.42
Endrin ketone	1.E-04	1.E-05	0.036	0.36	4.09E-06	1	1	4.09E-06		1.0	0.34	0	1.0	0.00072	0.0020	0.35	2 7E-06	0 98	0.65
Gamma Chlordane	3.E-06	2 E-06	1.8	3.6	6.00E-06	1	1	6.00E-06		1.0	0.34	0	1.0	0.0030	0 0020	1.0		0.98	0
gamma-BHC (Lindane)	2.E-06	2.E-07	5.8	58	1.33E-05	1	1	1 33E-05		1.0	0.34	0	1.0	0.0048	0.0020	0.72	3 8E-06	0.98	0 28
Heptachlor	8.E-03	8 E-04	0.094	0 94	7.85E-04	1	1	7.85E-04	0.0023	1.0	0.34	1.0	1.0	0 0000	0.0020	0	2.9E-06	0.98	0 0036
Heptachlor epoxide	1.E-04	1.E-05	0.094	0.94	1.05E-05	1	1	1.05E-05		1.0	0.34	0	1.0	0.0048	0 0020	0.91	9.6E-07	0.98	0.089
Methoxychlor	6.E-04	3.E-04	2.9	5.8	1.84E-03	1	1	1.84E-03	0 0054	1.0	0.34	1.0	1.0	0.0000	0.0020	0		0.98	0
bis(2-ethylhexyl)phthalat	8.E-03	8.E-04	7.17	71.7	5.78E-02	1	1	5.78E-02	0.17	1.0	0.34	1.0	1.0	0	0.0020	0		0.98	0
Di-n-butylphthalate	0.E+00	0.E+00	215	718	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Diethylphthalate	2.E-05	NB	1795	NA	4.08E-02	1	1	4.08E-02	0.12	1.0	0.34	1.0	1.0	0	0.0020	0		0.98	0
Acenaphthylene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Fluoranthene	0.E+00	NB	196	NA	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Benzo(b)fluoranthene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Benzo(k)fluoranthene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Benzo(a)pyrene	0.E+00	0.E+00	0.39	3.9	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Indeno(1,2,3-c-d)pyrene	NB	NB	NA	NA	0.00E+00	1	1	0 00E+00		1.0	0 34	0	1.0	0	0.0020	0		0.98	0
Dibenz(a,h)anthracene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00		1.0	0.34	0	1.0	0	0.0020	0		0.98	0
Dioxin - TEQ	2.E-01	2.E-02	7.20E-07	7.20E-06	1.17E-07	1	1	1.17E-07	1.5E-07	1.0	0.34	0.42	1 0	3.3E-05	0.0020	0.57	9.4E-10	0.98	0.0078

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Site area is larger than foraging area therefore a site area to forage area ratio of 1 is applied to the exposure dose
Food Chain Model Components:
Hazard Index Estimate = [Food Dose] + [Sediment Dose] + [Drinking Water Dose]
Toxicological Benchmark

Food and Water Ingestion Rate (EPA 1993).

Appendix F
River Otter Food Chain Model - Clam Ingestion - Average Concentrations - Borrow Pit Lake
Sauget Area I

									Food					Sediment[1]				Water[2]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Exposure Dose mg/kg/day	Time on Site Ratio	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Clam Concentration mg/kg	Proportion Clams In Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	9.E-08	2.E-08	0.47	2.3	4.24E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.011	0.00040	1.00		0.08	0.000
Dicamba	6.E-07	2.E-07	0.19	0.63	1.13E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.028	0.00040	0.00		0.08	0.000
Dichloroprop	NB	NB	NA	NA	1.90E-05	1	0.01	0	0.018	0.018	1.0	0.10	0.97	1.0	0.14	0.00040	0.030		0.08	0.000
MCPA	3.E-06	1.E-06	3.5	10	1.13E-05	1	0.01	0	0		1.0	0.10	0.00	1.0	2.8	0.00040	0.00		0.08	0.000
MCPP	3.E-03	1.E-03	1.4	4.2	4.01E-03	1	0.01	0	4	4	1.0	0.10	1.0	1.0	2.8	0.00040	0.00		0.08	0.000
Aluminum, Total	1.E-01	1.E-02	0.467	4.67	6.64E-02	1	0.01	7	11	10.5	1.0	0.10	0.16	1.0	13667	0.00040	0.82	1.6	0.08	0.019
Antimony	3.E-04	3.E-05	0.032	0.32	8.87E-06	1	0.01	0	0		1.0	0.10	0.00	1.0	2.2	0.00040	1.0		0.08	0.000
Arsenic, Total	9.E-04	NB	1.2	NA	1.03E-03	1	0.01	0	0.96	0.96	1.0	0.10	0.93	1.0	16	0.00040	0.061	0.012	0.08	0.0090
Barium	2.E-04	2.E-04	6.8	9.75	1.53E-03	1	0.01	0	0		1.0	0.10	0.00	1.0	350	0.00040	0.92	0.16	0.08	0.085
Cadmium, Total	3.E-04	3.E-05	0.450	4.5	1.28E-04	1	0.01	0	0.12	0.12	1.0	0.10	0.93	1.0	2.1	0.00040	0.065		0.08	0.000
Chromium, Total	6.E-07	NB	1276	NA	7.70E-04	1	0.01	0	0.68	0.68	1.0	0.10	0.88	1.0	22	0.00040	0.11	0.0041	0.08	0.0043
Copper, Total	1.E-04	1.E-04	7.1	9.18	1.06E-03	1	0.01	0	0.86	0.86	1.0	0.10	0.81	1.0	49	0.00040	0.18	0.0053	0.08	0.0040
Iron	NB	NB	NA	NA	1.39E-01	1	0.01	14	0		1.0	0.10	0.00	1.0	34000	0.00040	0.98	3.9	0.08	0.022
Lead, Total	1.E-04	1.E-05	3.70	37	4.32E-04	1	0.01	0	0.23	0.23	1.0	0.10	0.54	1.0	48	0.00040	0.44	0.0083	0.08	0.015
Manganese	1.E-04	4.E-05	41.00	132	5.39E-03	1	0.01	1	0		1.0	0.10	0.00	1.0	1213	0.00040	0.90	0.67	0.08	0.099
Mercury	3.E-05	7.E-06	0.015	0.075	4.93E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.12	0.00040	1.0		0.08	0.000
Molybdenum	8.E-05	8.E-06	0.066	0.66	5.59E-06	1	0.01	0	0		1.0	0.10	0.00	1.0	0.60	0.00040	0.43	0.0040	0.08	0.57
Nickel, Total	1.E-05	5.E-06	19.00	37	1.99E-04	1	0.01	0	0		1.0	0.10	0.00	1.0	47	0.00040	0.95	0.012	0.08	0.047
Silver	2.E-06	2.E-07	10.30	104	1.96E-05	1	0.01	0	0.015	0.015	1.0	0.10	0.77	1.0	1	0.00040	0.23		0.08	0.000
Zinc, Total	2.E-04	1.E-04	75.0	149	1.62E-02	1	0.01	2	15	15	1.0	0.10	0.92	1.0	310	0.00040	0.076	0.031	0.08	0.002
Total PCBs	8.E-07	4.E-07	0.085	0.17	6.40E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.016	0.00040	0.00		0.08	0.000
Total DDT	1.E-07	2.E-08	0.4	2	3.63E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0091	0.00040	1.0		0.08	0.000
Aldrin	2.E-07	4.E-08	0.093	0.47	1.76E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0044	0.00040	0.00		0.08	0.000
Alpha Chlordane	5.E-09	3.E-09	1.2	2.3	6.51E-09	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0018	0.00040	1.0		0.08	0.000
delta-BHC	8.E-07	8.E-08	0.0085	0.085	6.96E-09	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0013	0.00040	0.75	2.2E-06	0.08	0.25
Dieldrin	2.E-06	2.E-07	0.009	0.09	1.38E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0033	0.00040	0.94	0.0000010	0.08	0.058
Endosulfan I	2.E-07	NB	0.07	NA	1.35E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0029	0.00040	0.86	2.4E-06	0.08	0.14
Endosulfan II	5.E-07	NB	0.07	NA	3.40E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0085	0.00040	0.00		0.08	0.000
Endosulfan sulfate	4.E-07	NB	0.07	NA	2.91E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0066	0.00040	0.91	3.2E-06	0.08	0.088
Endrin aldehyde	4.E-07	4.E-08	0.023	0.23	8.96E-09	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0016	0.00040	0.71	3.2E-06	0.08	0.29
Endrin ketone	1.E-06	1.E-07	0.023	0.23	2.78E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0064	0.00040	0.92	2.7E-06	0.08	0.078
Gamma Chlordane	9.E-09	5.E-09	1.2	2.3	1.13E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0028	0.00040	1.0		0.08	0.000
gamma-BHC (Lindane)	6.E-09	6.E-10	3.7	37	2.23E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0048	0.00040	0.86	3.8E-06	0.08	0.14
Heptachlor	4.E-05	4.E-06	0.061	0.61	2.32E-06	1	0.01	0	0.0023	0.0023	1.0	0.10	0.99	1.0	0.0044	0.00040	0.008	2.6E-06	0.08	0.001
Heptachlor epoxide	3.E-07	3.E-08	0.061	0.61	2.00E-08	1	0.01	0	0		1.0	0.10	0.00	1.0	0.0048	0.00040	0.96	9.6E-07	0.08	0.038
Methoxychlor	3.E-06	2.E-06	1.9	3.7	5.58E-06	1	0.01	0	0.0054	0.0054	1.0	0.10	0.97	1.0	0.044	0.00040	0.032		0.08	0.000
Acenaphthylene	NB	NB	NA	NA	9.60E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Benzo(a)pyrene	2.E-06	2.E-07	0.25	2.5	5.07E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.13	0.00040	0.00		0.08	0.000
Benzo(b)fluoranthene	NB	NB	NA	NA	9.60E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Benzo(k)fluoranthene	NB	NB	NA	NA	9.60E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Bis(2-ethyhexyl)phthalate	2.E-05	2.E-06	4.62	46.2	1.00E-04	1	0.01	0	0.099	0.099	1.0	0.10	0.99	1.0	0.24	0.00040	0.010		0.08	0.000
Di-n-butylphthalate	7.E-09	2.E-09	139	463	9.60E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Dibenzo(a,h)anthracene	NB	NB	NA	NA	5.07E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.13	0.00040	0.00		0.08	0.000
Diethylphthalate	7.E-08	NB	1156	NA	7.63E-05	1	0.01	0	0.075	0.075	1.0	0.10	0.99	1.0	0.24	0.00040	0.013		0.08	0.000
Fluoranthene	8.E-09	NB	126	NA	9.60E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Indeno(1,2,3-c,d)pyrene	NB	NB	NA	NA	9.60E-07	1	0.01	0	0		1.0	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Dioxin	4.E-04	4.E-05	4.6835E-07	4.683E-06	1.71E-10	1	0.01	0	8.3E-08	8.3E-08	1.0	0.10	0.49	1.0	2.2E-05	0.00040	0.51	6.96E-10	0.08	0.003

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Half the detection limit is used for compounds that were not detected.

Food Chain Model Components:

Hazard Index Estimate = $\frac{\text{[Food Dose] + [Sediment Dose] + [Drinking Water Dose]}}{\text{Toxicological Benchmark}}$

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the sediment component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%; plant moisture=70%) and then calculate a sediment ingestion rate from the sediment proportion in the diet (dry weight) estimated in Beyer et al. (1994)

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Appendix F
River Otter Food Chain Model -Clam Ingestion - Maximum Concentrations - Borrow Pit Lake
Sauget Area I

									Food					Sediment[1]				Water[2]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Exposure Dose mg/kg	Time on Site Ratio	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Clam Concentration mg/kg	Proportion Clams in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	9.E-06	2.E-06	0.47	2.3	4.40E-06	1	1	4.40E-06			1.0	0.10	0.00	1.0	0.011	0.00040	1.0		0.08	0.000
Dicamba	0.E+00	0.E+00	0 19	0 63	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0	0 00040	0.00		0.08	0 000
Dichloroprop	NB	NB	NA	NA	3 20E-03	1	1	3 20E-03	0.032		1.0	0.10	1.0	1.0	0	0.00040	0.00		0.08	0.000
MCPA	0.E+00	0.E+00	3 5	10	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1 0	0	0.00040	0.00		0.08	0 000
MCPP	3 E-01	1.E-01	1.4	4.2	4.00E-01	1	1	4.00E-01	4		1.0	0.10	1.0	1.0	0	0.00040	0.00		0.08	0.000
Aluminum, Total	**2.E+01**	**2.E+00**	0.487	4.87	7.97E+00	1	1	7.97E+00	13		1.0	0.10	0 16	1.0	16000	0 00040	0.80	3.4	0.08	0.034
Antimony	3.E-02	3.E-03	0.032	0.32	8 80E-04	1	1	8.80E-04			1.0	0.10	0.00	1.0	2 2	0.00040	1.0		0 08	0.000
Arsenic, Total	9 E-02	NB	1.2	NA	1.04E-01	1	1	1.04E-01	0.96		1.0	0.10	0.92	1.0	17	0 00040	0.065	0.015	0.08	0 012
Barium	3.E-02	2.E-02	6.8	9.75	1.94E-01	1	1	1.94E-01			1.0	0.10	0.00	1.0	420	0.00040	0.87	0.32	0.08	0.132
Cadmium, Total	3.E-02	3.E-03	0.450	4.5	1 31E-02	1	1	1.31E-02	0.12		1.0	0.10	0.92	1.0	2.7	0.00040	0.083		0.08	0.000
Chromium, Total	9.E-05	NB	1276	NA	1.21E-01	1	1	1.21E-01	1.1		1.0	0.10	0.91	1.0	26	0.00040	0.086	0.0041	0.08	0.0027
Copper, Total	2.E-02	1.E-02	7.1	9.18	1.25E-01	1	1	1 25E-01	0.99		1.0	0.10	0.79	1.0	64	0.00040	0.20	0.0074	0.08	0.0047
Iron	NB	NB	NA	NA	1.59E+01	1	1	1.59E+01			1.0	0.10	0.00	1.0	38000	0.00040	0.96	8.7	0 08	0.044
Lead, Total	1.E-02	1.E-03	3.70	37	4.98E-02	1	1	4.98E-02	0.25		1.0	0.10	0.50	1.0	58	0.00040	0.47	0.020	0.08	0 032
Manganese	2.E-02	5.E-03	41.00	132	6.96E-01	1	1	6.96E-01			1.0	0.10	0.00	1.0	1400	0.00040	0.80	1.7	0.08	0.195
Mercury	4.E-03	9.E-04	0.015	0.075	6.40E-05	1	1	6.40E-05			1.0	0.10	0.00	1.0	0.16	0.00040	1.0		0 08	0.000
Molybdenum	1.E-02	1.E-03	0.066	0.66	6.68E-04	1	1	6.68E-04			1.0	0.10	0.00	1.0	0.92	0.00040	0.53	0.0040	0.08	0.465
Nickel, Total	1.E-03	6.E-04	19.00	37	2.28E-02	1	1	2.28E-02			1.0	0.10	0.00	1.0	54	0.00040	0.95	0.015	0.08	0.053
Silver	2.E-04	2.E-05	10.30	104	1.82E-03	1	1	1.82E-03	0.015		1.0	0.10	0.83	1.0	0.79	0.00040	0.17		0.08	0.000
Zinc, Total	3.E-02	2.E-02	75.0	149	2.35E+00	1	1	2.35E+00	22		1.0	0.10	0.94	1.0	370	0.00040	0.063	0.046	0.08	0.002
Total PCBs	0.E+00	0.E+00	0.085	0.17	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Total DDT	2.E-05	4.E-06	0.4	2	8.80E-06	1	1	8.80E-06			1.0	0.10	0.00	1.0	0.022	0.00040	1.0		0.08	0.000
Aldrin	0.E+00	0.E+00	0.093	0.47	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Alpha Chlordane	1.E-06	6.E-07	1.2	2.3	1.28E-06	1	1	1.28E-06			1.0	0.10	0.00	1.0	0.0032	0.00040	1.0		0.08	0.000
delta-BHC	2.E-05	2.E-06	0.0085	0.085	1.76E-07	1	1	1.76E-07			1.0	0.10	0.00	1.0	0	0.00040	0.00	2.2E-06	0.08	1.0
Dieldrin	3.E-05	3.E-06	0.009	0.09	2.80E-07	1	1	2.80E-07			1.0	0.10	0.00	1.0	0.00050	0.00040	0.71	0.000001	0.08	0.29
Endosulfan I	3.E-05	NB	0.07	NA	2.15E-06	1	1	2.15E-06			1.0	0.10	0.00	1.0	0.0049	0.00040	0.91	2.4E-06	0.08	0.089
Endosulfan II	0.E+00	NB	0.07	NA	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Endosulfan sulfate	6.E-05	NB	0.07	NA	4.06E-06	1	1	4.06E-06			1.0	0.10	0.00	1.0	0.0095	0.00040	0.94	3.2E-06	0.08	0.063
Endrin aldehyde	5.E-05	5.E-06	0.023	0.23	1.14E-06	1	1	1.14E-06			1.0	0.10	0.00	1.0	0.0022	0.00040	0.77	3.2E-06	0.08	0.23
Endrin ketone	2 E-05	2.E-06	0.023	0.23	5.04E-07	1	1	5.04E-07			1.0	0.10	0.00	1.0	0.00072	0.00040	0.57	2.7E-06	0.08	0.43
Gamma Chlordane	1.E-06	5.E-07	1.2	2.3	1.20E-06	1	1	1.20E-06			1.0	0.10	0.00	1.0	0.0030	0.00040	1.0		0.08	0.000
gamma-BHC (Lindane)	6.E-07	6 E-08	3.7	37	2.22E-06	1	1	2.22E-06			1.0	0.10	0.00	1.0	0.0048	0.00040	0.86	3.8E-06	0 08	0.14
Heptachlor	4 E-03	4.E-04	0.061	0.61	2.30E-04	1	1	2.30E-04	0.0023		1.0	0.10	1.0	1.0	0	0.00040	0.00	2.9E-06	0.08	0.0010
Heptachlor epoxide	3.E-05	3.E-06	0 061	0.61	2.00E-06	1	1	2.00E-06			1.0	0 10	0.00	1.0	0 0048	0.00040	0.96	9 6E-07	0.08	0.038
Methoxychlor	3.E-04	1 E-04	1.9	3 7	5.40E-04	1	1	5.40E-04	0.0054		1.0	0.10	1.0	1.0	0	0.00040	0.00		0 08	0.000
Acenaphthylene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1 0	0.0000	0.00040	0 00		0 08	0.000
Benzo(a)pyrene	0.E+00	0.E+00	0.25	2.5	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0.0000	0.00040	0.00		0.08	0.000
Benzo(b)fluoranthene	*NB*	*NB*	NA	NA	0.00E+00	1	1	0.00E+00			1.0	0.10	0 00	1.0	0.0000	0.00040	0.00		0.08	0.000
Benzo(k)fluoranthene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0.0000	0.00040	0.00		0 08	0.000
Bis(2-ethyhexyl)phthalate	4.E-03	4.E-04	4.62	46.2	1.70E-02	1	1	1.70E-02	0.17		1.0	0.10	1.0	1 0	0.0000	0.00040	0 00		0.08	0.000
Di-n-butylphthalate	0.E+00	0.E+00	139	463	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0.0000	0.00040	0.00		0.08	0.000
Dibenzo(a,h)anthracene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0.0000	0.00040	0.00		0.08	0.000
Diethylphthalate	1 E-05	NB	1156	NA	1.20E-02	1	1	1.20E-02	0.12		1.0	0.10	1.0	1.0	0.0000	0.00040	0.00		0.08	0.000
Fluoranthene	0.E+00	NB	126	NA	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0.0000	0.00040	0.00		0.08	0.000
Indeno(1,2,3-c,d)pyrene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00			1.0	0.10	0.00	1.0	0.0000	0.00040	0.00		0.08	0.000
Dioxin	6.E-02	6.E-03	4.6635E-07	4.663E-06	2.80E-08	1	1	2.80E-08	1.5E-07		1.0	0.10	0 52	1.0	3.3E-05	0.00040	0.48	9.4E-10	0.08	0 0027

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Half the detection limit is used for compounds that were not detected.

Food Chain Model Components:

$$\text{Hazard Index Estimate} = \frac{[\text{Food Dose}] + [\text{Sediment Dose}] + [\text{Drinking Water Dose}]}{\text{Toxicological Benchmark}}$$

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the sediment component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%; plant moisture=70%) and then calculate a sediment ingestion rate from the sediment proportion in the diet (dry weight) estimated in Beyer et al. (1994)

Appendix F
River Otter Food Chain Model - Fish Ingestion - Average Concentrations - Borrow Pit Lake
Sauget Area I

									Food								Sediment[1]				Water[2]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Exposure Dose mg/kg	Ratio of Forage Area to Site	Time on Site Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Large Fish Concentration mg/kg	Proportion Large Fish in Diet	Forager Concentration mg/kg	Proportion Forager in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	9.E-08	2.E-08	0.47	2.3	4.24E-08	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.011	0.00040	1.00		0.08	0.000
Dicamba	3.E-05	9 E-06	0.19	0 63	5.87E-06	0.01	1	0	0.0058	0.0070	0.72	0.0026	0.28	0.10	0.98	1.0	0.028	0.00040	0.019		0.08	0.000
Dichloroprop	NB	NB	NA	NA	7.19E-06	0.01	1	0	0.0066	0.0066	0.72	0.0067	0.28	0 10	0.92	1.0	0.14	0.00040	0.079		0.08	0.000
MCPA	5.E-04	2.E-04	3.5	10	1.61E-03	0.01	1	0	1.6	1.1	0.72	2.8	0.28	0.10	0.99	1.0	2.8	0.00040	0.0070		0.08	0.000
MCPP	8.E-06	3.E-06	1.4	4.2	1 13E-05	0.01	1	0	0		0.72		0.28	0 10	0.00	1.0	2.8	0.00040	0.00		0.08	0.000
Aluminum, Total	2.E-01	2.E-02	0.487	4.87	7.87E-02	0.01	1	8	23	16	0.72	40	0.28	0.10	0.29	1.0	13667	0.00040	0.69	1.6	0.08	0.016
Antimony	3.E-04	3.E-05	0.032	0.32	8.87E-06	0.01	1	0	0		0.72		0 28	0.10	0.00	1.0	2.2	0.00040	1.0		0.08	0.000
Arsenic, Total	6.E-05	NB	1.2	NA	7.20E-05	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	16	0.00040	0.87	0.012	0.08	0.13
Barium	2 E-04	2.E-04	6.8	9.75	1.53E-03	0.01	1	0	0		0.72		0.28	0.10	0 00	1.0	350	0.00040	0.92	0.16	0.08	0.085
Cadmium, Total	2.E-05	2.E-06	0.450	4.5	8.40E-06	0.01	1	0	0		0 72		0.28	0.10	0.00	1.0	2.1	0.00040	1.0		0.08	0.000
Chromium, Total	4.E-07	NB	1276	NA	5.55E-04	0.01	1	0	0.46	0.53	0.72	0.29	0.28	0.10	0.84	1.0	22	0.00040	0.16	0 0041	0.08	0.0059
Copper, Total	1.E-04	1.E-04	7.1	9.18	9.74E-04	0.01	1	0	0.77	0.69	0.72	0.99	0.28	0.10	0.80	1.0	49	0.00040	0.20	0.0053	0.08	0.0043
Iron	NB	NB	NA	NA	1.39E-01	0.01	1	14	0		0.72		0.28	0.10	0.00	1.0	34000	0.00040	0.98	3.9	0.08	0.022
Lead, Total	1.E-04	1.E-05	3 70	37	4.69E-04	0.01	1	0	0.27	0.24	0.72	0.36	0.28	0.10	0.58	1.0	48	0.00040	0.41	0.0083	0.08	0.014
Manganese	1.E-04	4.E-05	41.00	132	5.39E-03	0.01	1	1	0		0.72		0.28	0.10	0.00	1.0	1213	0.00040	0.90	0.67	0.08	0.099
Mercury	9.E-03	2.E-03	0.015	0.075	1.28E-04	0.01	1	0	0 13	0.086	0 72	0.23	0.28	0.10	1.0	1 0	0.12	0.00040	0.00		0.08	0.000
Molybdenum	6.E-05	8.E-06	0.066	0.66	5.59E-06	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.60	0.00040	0.43	0.0040	0.08	0.57
Nickel, Total	1.E-05	5.E-06	19.00	37	1.99E-04	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	47	0.00040	0.95	0.012	0.08	0.047
Silver	4.E-07	4.E-08	10.30	104	4.59E-06	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	1.1	0.00040	0.00		0.08	0.000
Zinc, Total	3.E-04	2.E-04	75.0	149	2.28E-02	0.01	1	2	22	18	0 72	30	0.28	0.10	0.94	1.0	310	0.00040	0.054	0.031	0.08	0.0011
Total PCBs	1.E-03	7.E-04	0.085	0.17	1.16E-04	0.01	1	0	0.12	0.15	0.72	0.030	0.28	0.10	1.0	1.0	0.016	0.00040	0.00		0.08	0.000
Total DDT	4 E-05	7.E-06	0.4	2	1.37E-05	0.01	1	0	0.014	0.016	0.72	0.0077	0.28	0.10	1.0	1.0	0.0091	0.00040	0.00		0.08	0.000
Aldrin	2.E-07	4.E-08	0.093	0.47	1.76E-08	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.0044	0.00040	0.00		0.08	0.000
Alpha Chlordane	3.E-06	2.E-06	1.2	2.3	3.92E-06	0.01	1	0	0.0039	0.0054	0.72		0.28	0.10	1.0	1.0	0.0016	0.00040	0.00		0.08	0.000
delta-BHC	8 E-07	8 E-08	0.0085	0.085	6.96E-09	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.0013	0.00040	0.75	2 2E-06	0.08	0.25
Dieldrin	2.E-06	2 E-07	0.009	0.09	1.38E-08	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.0033	0.00040	0.94	0.000001	0.08	0.058
Endosulfan I	2.E-07	NB	0.07	NA	1.35E-08	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.0029	0.00040	0.86	2.4E-06	0.08	0.14
Endosulfan II	5.E-07	NB	0 07	NA	3.40E-08	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.0085	0 00040	0.00		0.08	0.000
Endosulfan sulfate	4.E-07	NB	0.07	NA	2.91E-08	0.01	1	0	0		0.72		0 28	0.10	0.00	1.0	0.0066	0.00040	0.91	3.2E-06	0.08	0 088
Endrin aldehyde	4.E-07	4.E-08	0.023	0.23	8.96E-09	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0 0016	0.00040	0.71	3.2E-06	0.08	0.29
Endrin ketone	1.E-06	1 E-07	0 023	0.23	2.78E-08	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.0064	0.00040	0.92	2 7E-06	0.08	0.078
Gamma Chlordane	6.E-06	3.E-06	1.2	2.3	7.07E-06	0.01	1	0	0 0071	0.0098	0.72		0.28	0.10	1.0	1.0	0.0028	0.00040	0.00		0.08	0.000
gamma-BHC (Lindane)	6.E-09	6.E-10	3.7	37	2.23E-08	0.01	1	0	0		0.72		0.28	0 10	0.00	1.0	0.0048	0.00040	0.86	3.8E-06	0.08	0.14
Heptachlor	3.E-05	3.E-06	0.061	0.61	2.04E-06	0.01	1	0	0.0020	0.0028	0.72		0.28	0.10	0.99	1.0	0.0044	0.00040	0.0086	2.6E-06	0.08	0.0010
Heptachlor epoxide	3 E-07	3.E-08	0.061	0.61	2.00E-08	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.0048	0.00040	0.96	9 6E-07	0.08	0.036
Methoxychlor	9.E-08	5.E-08	1.9	3.7	1.76E-07	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.044	0.00040	0.00		0.08	0.000
Acenaphthylene	NB	NB	NA	NA	9.60E-07	0.01	1	0	0		0.72		0.28	0 10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Benzo(a)pyrene	2 E-06	2.E-07	0.25	2 5	5.07E-07	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.13	0.00040	0.00		0.08	0.000
Benzo(b)fluoranthene	NB	NB	NA	NA	9.60E-07	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Benzo(k)fluoranthene	NB	NB	NA	NA	9 60E-07	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.24	0.00040	0.00		0 08	0.000
Bis(2-ethylhexyl)phthalate	3.E-05	3.E-06	4.62	46.2	1.17E-04	0.01	1	0	0.12	0.090	0.72	0.18	0.28	0.10	0.99	1.0	0.24	0.00040	0.0082		0.08	0.000
Di-n-butylphthalate	2.E-07	5.E-08	139	463	2.40E-05	0.01	1	0	0.023	0.032	0.72		0.28	0.10	0.96	1.0	0.24	0.00040	0 040		0.08	0.000
Dibenzo(a,h)anthracene	NB	NB	NA	NA	1.39E-05	0.01	1	0	0.013		0 72	0.048	0.28	0.10	0.96	1.0	0.13	0.00040	0.036		0.08	0.000
Diethylphthalate	2.E-08	NB	1156	NA	2.25E-05	0.01	1	0	0.022	0.016	0.72	0.031	0.28	0.10	0.96	1.0	0.24	0.00040	0.043		0.08	0.000
Fluoranthene	8.E-09	NB	128	NA	9.60E-07	0.01	1	0	0		0.72		0.28	0.10	0.00	1.0	0.24	0.00040	0.00		0.08	0.000
Indeno(1,2,3-c,d)pyrene	NB	NB	NA	NA	1.61E-05	0.01	1	0	0.015		0.72	0.054	0.28	0.10	0.94	1.0	0.24	0.00040	0.060		0.08	0.000
Dioxin	5.E-03	5.E-04	4.6635E-07	4.663E-06	2.35E-09	0.01	1	0	2.3E-06	2.7E-06	0.72	1.2E-06	0.28	0.10	0.96	1.0	2.2E-05	0.00040	0.037	7.0E-10	0.08	0.000

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Half the detection limit is used for compounds that were not detected.

Food Chain Model Components:
Hazard Index Estimate = [Food Dose] + [Sediment Dose] + [Drinking Water Dose] / Toxicological Benchmark

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the sediment component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%; plant moisture=70%) and then calculate a sediment ingestion rate from the sediment proportion in the diet (dry weight) estimated in Beyer et al. (1994)

Appendix F
River Otter Food Chain Model - Fish Ingestion - Maximum Concentrations - Borrow Pit Lake
Sauget Area I

									Food								Sediment[1]				Water[2]		
Compound	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose	LOAEL Benchmark Dose	Overall Exposure Dose mg/kg	Ratio of Forage Area to Site	Time on Site Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Large Fish Concentration mg/kg	Proportion Large Fish In Diet	Forager Concentration mg/kg	Proportion Forager in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	RAF	Conc. in Sediment mg/kg	Dry Sediment Ing. Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	9.E-06	2.E-06	0.47	2.3	4.40E-06	1	1	4 40E-06	0		0.72		0.28	0.10	0.00	1	0.011	0.0004	1.0		0.08	0.000
Dicamba	1.E-03	3.E-04	0.19	0.63	2.10E-04	1	1	2.10E-04	0.0021	0.0019	0.72	0.0026	0.28	0.10	1.0	1	0	0.0004	0.00		0.08	0.000
Dichloroprop	NB	NB	NA	NA	6.63E-04	1	1	6.63E-04	0.0066	0.0066	0.72	0.0067	0.28	0.10	1.0	1	0	0.0004	0.00		0.08	0.000
MCPA	6 E-02	2.E-02	3.5	10	2.22E-01	1	1	2.22E-01	2.2	1.8	0 72	3.3	0.28	0.10	1.0	1	0	0.0004	0.00		0.08	0.000
MCPP	0.E+00	0.E+00	1.4	4.2	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.00	1	0	0.0004	0.00		0.08	0.000
Aluminum, Total	**2.E+01**	**2.E+00**	0.487	4.87	1 05E+01	1	1	1.05E+01	38	33	0.72	52	0.28	0.10	0.36	1	16000	0.0004	0.61	3.4	0.08	0.026
Antimony	3.E-02	3.E-03	0.032	0.32	8.80E-04	1	1	8 80E-04	0		0.72		0.28	0.10	0.00	1	2.2	0.0004	1.0		0.08	0.000
Arsenic, Total	7.E-03	NB	1.2	NA	8.00E-03	1	1	8.00E-03	0		0.72		0.28	0.10	0.00	1	17	0.0004	0.85	0.015	0 08	0.15
Barium	3 E-02	2.E-02	6.8	9.75	1.94E-01	1	1	1.94E-01	0		0.72		0.28	0.10	0.00	1	420	0.0004	0.87	0.32	0.08	0.13
Cadmium, Total	2.E-03	2.E-04	0.450	4.5	1.08E-03	1	1	1.08E-03	0		0.72		0.28	0.10	0	1	2.7	0.0004	1.0		0.08	0.000
Chromium, Total	7.E-05	NB	1276	NA	8 66E-02	1	1	8.66E-02	0.76	0.93	0.72	0.32	0.28	0.10	0.88	1	26	0.0004	0 12	0.0041	0.08	0.0038
Copper, Total	2.E-02	2.E-02	7.1	9.18	1.38E-01	1	1	1.38E-01	1.1	0.89	0.72	1.7	0.28	0.10	0.81	1	64	0.0004	0.19	0.0074	0.08	0.0043
Iron	NB	NB	NA	NA	1.59E+01	1	1	1.59E+01	0		0.72		0.28	0 10	0.00	1	38000	0.0004	0.96	8.7	0.08	0.044
Lead, Total	*2.E-02*	*2.E-03*	*3.70*	*37*	*5.93E-02*	*1*	*1*	*5.93E-02*	*0.35*	*0.25*	*0.72*	*0.59*	*0.28*	*0.10*	*0.58*	*1*	*58*	*0.0004*	*0.39*	*0.020*	*0.08*	*0.027*
Manganese	2.E-02	5.E-03	41.00	132	6.96E-01	1	1	6.96E-01	0		0.72		0.28	0 10	0.00	1	1400	0.0004	0.80	1.7	0.08	0.20
Mercury	**2.E+00**	5.E-01	0.015	0.075	3.56E-02	1	1	3.56E-02	0.36	0.26	0.72	0.60	0.28	0.10	1.0	1	0.16	0.0004	0.0018		0.08	0.000
Molybdenum	1.E-02	1.E-03	0.066	0.66	6.88E-04	1	1	6.88E-04	0		0.72		0.28	0.10	0.00	1	0.92	0.0004	0.53	0.0040	0.08	0.47
Nickel, Total	1.E-03	6.E-04	19.00	37	2.28E-02	1	1	2.28E-02	0		0.72		0.28	0.10	0.00	1	54	0.0004	0.95	0.015	0.08	0.053
Silver	3.E-05	3.E-06	10.30	104	3.16E-04	1	1	3.16E-04	0		0.72		0.28	0.10	0.00	1	0.79	0.0004	0.00		0.08	0.000
Zinc, Total	4.E-02	2.E-02	75.0	149	2.66E+00	1	1	2.66E+00	25	22	0.72	33	0.28	0.10	0.94	1	370	0.0004	0.056	0.048	0.08	0.0014
Total PCBs	3.E-01	1.E-01	0.065	0.17	2.41E-02	1	1	2.41E-02	0.24	0.32	0.72	0.039	0.28	0.10	1.0	1	0	0.0004	0.00		0.08	0.000
Total DDT	6.E-03	1.E-03	0.4	2	2.38E-03	1	1	2.38E-03	0.024	0.029	0.72	0.010	0.28	0.10	1.0	1	0.022	0.0004	0.00		0.08	0.000
Aldrin	0.E+00	0.E+00	0.093	0.47	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.00	1	0	0.0004	0.00		0.08	0.000
Alpha Chlordane	7.E-04	4.E-04	1.2	2.3	8.65E-04	1	1	8.65E-04	0.0086	0.012	0.72		0.28	0.10	1.0	1	0.0032	0.0004	0.00		0.08	0.000
delta-BHC	2.E-05	2.E-06	0.0065	0.065	1.76E-07	1	1	1.76E-07	0		0.72		0.28	0.10	0.00	1	0	0.0004	0.00	2.2E-06	0.08	1.0
Dieldrin	3.E-05	3.E-06	0.009	0.09	2.80E-07	1	1	2.80E-07	0		0.72		0.28	0.10	0.00	1	0.0005	0.0004	0.71	0.000001	0.08	0.29
Endosulfan I	3.E-05	NB	0.07	NA	2.15E-06	1	1	2.15E-06	0		0.72		0.28	0.10	0.00	1	0.0049	0.0004	0.91	2.4E-06	0.08	0.069
Endosulfan II	0.E+00	NB	0.07	NA	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.00	1	0	0.0004	0.00		0.08	0.000
Endosulfan sulfate	6.E-05	NB	0.07	NA	4.06E-06	1	1	4.06E-06	0		0.72		0.28	0.10	0.00	1	0.0095	0.0004	0.94	3.2E-06	0.08	0.063
Endrin aldehyde	5.E-05	5.E-06	0.023	0.23	1.14E-06	1	1	1.14E-06	0		0.72		0.28	0.10	0.00	1	0.0022	0.0004	0.77	3.2E-06	0.08	0.23
Endrin ketone	2.E-05	2.E-06	0.023	0.23	5.04E-07	1	1	5.04E-07	0		0.72		0.28	0.10	0.00	1.0	0.00072	0.00040	0.57	2.7E-06	0.08	0.43
Gamma Chlordane	1.E-03	6.E-04	1.2	2.3	1.37E-03	1	1	1.37E-03	0.014	0.019	0.72		0.28	0.10	1.0	1.0	0.0030	0.00040	0.00		0.08	0.000
gamma-BHC (Lindane)	6.E-07	6.E-08	3.7	37	2.22E-06	1	1	2.22E-06	0		0.72		0.28	0.10	0.00	1.0	0.0048	0 00040	0.86	3.8E-06	0.08	0.14
Heptachlor	3.E-03	3.E-04	0 061	0.61	2.02E-04	1	1	2.02E-04	0.0020	0 0028	0 72		0.28	0.10	1.0	1.0	0	0.00040	0.00	2.9E-06	0 08	0 0011
Heptachlor epoxide	3.E-05	3 E-06	0.061	0.61	2.00E-06	1	1	2.00E-06	0		0.72		0.28	0.10	0.00	1.0	0.0048	0 00040	0.96	9.6E-07	0.08	0.038
Methoxychlor	0.E+00	0 E+00	1.9	3.7	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Acenaphthylene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Benzo(a)pyrene	0.E+00	0.E+00	0.25	2.5	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Benzo(b)fluoranthene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00	0		0 72		0.28	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Benzo(k)fluoranthene	NB	NB	NA	NA	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.00	1.0	0	0.00040	0.00		0.08	0.000
Bis(2-ethyhexyl)phthalate	3.E-03	3.E-04	4.62	46.2	1.34E-02	1	1	1.34E-02	0 134	0.097	0.72	0.23	0.28	0.10	1.0	1.0	0	0.00040	0.00		0.08	0.000
Di-n-butylphthalate	2.E-05	5.E-06	139	463	2.30E-03	1	1	2.30E-03	0.023	0.032	0.72		0.28	0.10	1.0	1.0	0	0.00040	0.00		0.08	0.000
Dibenzo(a,h)anthracene	NB	NB	NA	NA	1.34E-03	1	1	1.34E-03	0.013		0.72	0.048	0.28	0.10	1.0	1.0	0	0.00040	0.00		0.08	0.000
Diethylphthalate	2.E-06	NB	1156	NA	2.33E-03	1	1	2.33E-03	0.023	0.018	0.72	0.037	0.28	0.10	1.0	1.0	0	0.00040	0.00		0.08	0.000
Fluoranthene	0.E+00	NB	126	NA	0.00E+00	1	1	0.00E+00	0		0.72		0.28	0.10	0.0	1.0	0	0.00040	0.00		0.08	0.000
Indeno(1,2,3-c,d)pyrene	NB	NB	NA	NA	1.51E-03	1	1	1.51E-03	0.015		0.72	0.054	0.28	0 10	1.0	1.0	0	0.00040	0.00		0.08	0.000
Dioxin	8.E-01	8.E-02	4.6635E-07	4.663E-06	3.94E-07	1	1	3.94E-07	3.8E-06	4.5612E-06	0.72	1.8E-06	0.28	0.10	0.97	1.0	3.3E-05	0.00040	0.034	9.4E-10	0.08	0.000

Notes:
NA=Not available/applicable
NB = Benchmark not available
Bolded values indicate a Hazard Index greater than 1
Half the detection limit is used for compounds that were not detected.

Food Chain Model Components:
Hazard Index Estimate = [Food Dose] + [Sediment Dose] + [Drinking Water Dose] / Toxicological Benchmark

Food and Drinking Water Ingestion Rate (EPA 1993)

**For the sediment component, we convert the food ingestion rate from wet weight to dry weight (invertebrate moisture=80%; plant moisture=70%) and then calculate a sediment ingestion rate from the sediment proportion in the diet (dry weight) estimated in Beyer et al. (1994)

Appendix F
Food Chain Model For Bald Eagle Ingesting Fish - Average Concentrations - Borrow Pit Lake
Sauget Area I

									Food					Water		
Contaminant	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Forage Area Normalized Exposure Dose mg/kg/day	Ratio for Time in Site Area	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Fish Tissue Concentration mg/kg wet	Proportion Fish In Diet	Ingestion Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	Bench NA	Bench NA	NA	NA	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Dicamba	Bench NA	Bench NA	NA	NA	1.26E-06	0.5	0.003	8.38E-04	0.0070	0.0070	1.0	0.12	1.0		0.037	0
Dichloroprop	Bench NA	Bench NA	NA	NA	1.19E-06	0.5	0.003	7.92E-04	0.0066	0.0066	1.0	0.12	1.0		0.037	0
MCPA	Bench NA	Bench NA	NA	NA	2.04E-04	0.5	0.003	1.36E-01	1.1	1.1	1.0	0.12	1.0		0.037	0
MCPP	Bench NA	Bench NA	NA	NA	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Aluminum, Total	3.E-05	Bench NA	109.7	NA	2.97E-03	0.5	0.003	1.98E+00	16	16	1.0	0.12	0.97	1.6	0.037	0.030
Antimony	Bench NA	Bench NA	NA	NA	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Arsenic, Total	1.E-07	5.E-08	5.14	12.84	6.46E-07	0.5	0.003	4.30E-04	0		1.0	0.12	0	0.012	0.037	1.0
Barium, Total	4.E-07	2.E-07	20.8	41.7	8.97E-06	0.5	0.003	5.98E-03	0		1.0	0.12	0	0.16	0.037	1.0
Cadmium, Total	0.E+00	0.E+00	1.45	20	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Chromium, Total	1.E-04	2.E-05	1	5	9.59E-05	0.5	0.003	6.40E-02	0.53	0.53	1.0	0.12	1.0	0.0041	0.037	0.0024
Copper, Total	3.E-06	2.E-06	47	61.7	1.24E-04	0.5	0.003	8.30E-02	0.69	0.69	1.0	0.12	1.0	0.0053	0.037	0.0023
Iron	Bench NA	Bench NA	NA	NA	2.15E-04	0.5	0.003	1.43E-01	0		1.0	0.12	0	3.9	0.037	1.0
Lead, Total	4.E-05	4.E-06	1.13	11.3	4.32E-05	0.5	0.003	2.88E-02	0.24	0.24	1.0	0.12	0.99	0.0063	0.037	0.011
Manganese	4.E-08	Bench NA	977	NA	3.70E-05	0.5	0.003	2.47E-02	0		1.0	0.12	0	0.67	0.037	1.0
Mercury	2.E-03	2.E-04	0.0064	0.064	1.54E-05	0.5	0.003	1.03E-02	0.086	0.086	1.0	0.12	1.0		0.037	0
Molybdenum	6.E-08	6.E-09	3.5	35.3	2.22E-07	0.5	0.003	1.48E-04	0		1.0	0.12	0	0.0040	0.037	1.0
Nickel, Total	8.E-09	6.E-09	77.4	107	6.42E-07	0.5	0.003	4.28E-04	0		1.0	0.12	0	0.012	0.037	1.0
Silver	Bench NA	Bench NA	NA	NA	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Zinc, Total	2.E-04	3.E-05	14.5	131	3.30E-03	0.5	0.003	2.20E+00	18	18	1.0	0.12	1.0	0.031	0.037	0.00052
Total PCBs	1.E-04	1.E-05	0.18	1.8	2.70E-05	0.5	0.003	1.80E-02	0.15	0.15	1.0	0.12	1.0		0.037	0
Total DDT	1.E-03	1.E-04	0.0028	0.028	2.88E-06	0.5	0.003	1.92E-03	0.016	0.016	1.0	0.12	1.0		0.037	0
Aldrin	Bench NA	Bench NA	NA	NA	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Alpha Chlordane	5.E-07	9.E-08	2.14	10.7	9.78E-07	0.5	0.003	6.52E-04	0.0054	0.0054	1.0	0.12	1.0		0.037	0
delta-BHC	2.E-10	5.E-11	0.56	2.25	1.22E-10	0.5	0.003	8.14E-08	0		1.0	0.12	0	0.0000022	0.037	1.0
Dieldrin	7.E-10	Bench NA	0.077	NA	5.55E-11	0.5	0.003	3.70E-08	0		1.0	0.12	0	0.000001	0.037	1.0
Endosulfan I	1.E-11	Bench NA	10	NA	1.33E-10	0.5	0.003	8.88E-08	0		1.0	0.12	0	0.0000024	0.037	1.0
Endosulfan II	0.E+00	Bench NA	10	NA	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Endosulfan sulfate	2.E-11	Bench NA	10	NA	1.78E-10	0.5	0.003	1.18E-07	0		1.0	0.12	0	0.0000032	0.037	1.0
Endrin aldehyde	2.E-08	2.E-09	0.01	0.1	1.78E-10	0.5	0.003	1.18E-07	0		1.0	0.12	0	0.0000032	0.037	1.0
Endrin ketone	1.E-08	1.E-09	0.01	0.1	1.50E-10	0.5	0.003	9.99E-08	0		1.0	0.12	0	0.0000027	0.037	1.0
Gamma Chlordane	8.E-07	2.E-07	2.14	10.7	1.76E-06	0.5	0.003	1.18E-03	0.0098	0.0098	1.0	0.12	1.0		0.037	0
gamma-BHC (Lindane)	1.E-10	1.E-11	2	20	2.11E-10	0.5	0.003	1.41E-07	0		1.0	0.12	0	0.0000038	0.037	1.0
Heptachlor	Bench NA	Bench NA	NA	NA	5.04E-07	0.5	0.003	3.36E-04	0.0028	0.0028	1.0	0.12	1.0	2.6E-06	0.037	0.00028
Heptachlor epoxide	Bench NA	Bench NA	NA	NA	5.33E-11	0.5	0.003	3.55E-08	0		1.0	0.12	0	9.6E-07	0.037	1.0
Methoxychlor	Bench NA	Bench NA	NA	NA	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
Total PAHs	0.E+00	0.E+00	40	400	0.00E+00	0.5	0.003	0.00E+00	0		1.0	0.12	0		0.037	0
bis(2-ethylhexyl)phthalat	1.E-05	Bench NA	1.1	NA	1.63E-05	0.5	0.003	1.08E-02	0.090	0.090	1.0	0.12	1.0		0.037	0
Di-n-butylphthalate	5.E-05	5.E-06	0.11	1.1	5.76E-06	0.5	0.003	3.84E-03	0.032	0.032	1.0	0.12	1.0		0.037	0
Diethylphthalate	Bench NA	Bench NA	NA	NA	3.24E-06	0.5	0.003	2.16E-03	0.018	0.018	1.0	0.12	1.0		0.037	0
Dioxin - TEQ	1.E-04	1.E-05	0.000014	0.00014	1.54E-09	0.5	0.003	1.02E-06	8.5E-06	8.5E-06	1.0	0.12	1.0	3.3E-10	0.037	1.2E-05

Notes:
NA = Not available/applicable
Bench NA = Benchmark not available

Food Chain Model Components:

$$\text{Hazard Index Estimate} = \frac{[\text{Food Dose}] + [\text{Sediment Dose}] + [\text{Drinking Water Dose}]}{\text{Toxicological Benchmark}}$$

Appendix F
Food Chain Model For Bald Eagle Ingesting Fish from the Borrow Pit Lake Maximum Concentrations
Sauget Area I

									Food					Water		
Contaminant	NOAEL Hazard Index	LOAEL Hazard Index	NOAEL Benchmark Dose mg/kg/d	LOAEL Benchmark Dose mg/kg/d	Forage Area Normalized Exposure Dose mg/kg/day	Ratio for Time in Site Area	Site Area to Forage Area Ratio	Exposure Dose mg/kg/day	Total Conc. in Food mg/kg wet	Fish Tissue Concentration mg/kg wet	Proportion Fish in Diet	Ingestion Rate kg/kg/day	Proportion of Dose	Conc. in Water mg/l	Ingestion Rate l/kg/day	Proportion of Dose
2,4-D	Bench NA	Bench NA	NA	NA	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Dicamba	Bench NA	Bench NA	NA	NA	2.28E-04	1	1	2 28E-04	0.0019	0.0019	1.0	0.12	1.0		0.037	0
Dichloroprop	Bench NA	Bench NA	NA	NA	7.92E-04	1	1	7.92E-04	0.0066	0.0066	1.0	0 12	1.0		0.037	0
MCPA	Bench NA	Bench NA	NA	NA	2.16E-01	1	1	2.16E-01	1.8	1.8	1.0	0.12	1.0		0.037	0
MCPP	Bench NA	Bench NA	NA	NA	0 00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Aluminum, Total	4.E-02	Bench NA	109.7	NA	4 09E+00	1	1	4.09E+00	33	33	1 0	0.12	0.97	3.4	0.037	0.031
Antimony	Bench NA	Bench NA	NA	NA	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Arsenic, Total	1.E-04	4.E-05	5.14	12.84	5.55E-04	1	1	5 55E-04	0		1.0	0.12	0	0.015	0.037	1.0
Barium, Total	6.E-04	3.E-04	20.8	41.7	1.16E-02	1	1	1.16E-02	0		1 0	0.12	0	0 32	0.037	1.0
Cadmium, Total	0.E+00	0.E+00	1.45	20	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Chromium, Total	1.E-01	2.E-02	1	5	1.12E-01	1	1	1.12E-01	0.93	0.93	1.0	0.12	1.0	0.0041	0.037	0.0014
Copper, Total	2.E-03	2.E-03	47	61.7	1.07E-01	1	1	1.07E-01	0.89	0.89	1.0	0.12	1.0	0.0074	0.037	0.0026
Iron	Bench NA	Bench NA	NA	NA	3.22E-01	1	1	3.22E-01	0		1.0	0.12	0	8.7	0.037	1.0
Lead, Total	3.E-02	3.E-03	1.13	11.3	3.07E-02	1	1	3.07E-02	0.25	0.25	1 0	0.12	0.98	0.020	0.037	0.024
Manganese	6.E-05	Bench NA	977	NA	6.29E-02	1	1	6.29E-02	0		1.0	0.12	0	1.7	0.037	1.0
Mercury	6.E+00	5.E-01	0.0064	0.064	3.12E-02	1	1	3.12E-02	0.26	0.26	1.0	0.12	1.0		0.037	0
Molybdenum	4.E-05	4.E-06	3.5	35.3	1.48E-04	1	1	1.48E-04	0		1.0	0.12	0	0.0040	0.037	1.0
Nickel, Total	7.E-06	5.E-06	77.4	107	5.55E-04	1	1	5.55E-04	0		1.0	0.12	0	0.015	0.037	1.0
Silver	Bench NA	Bench NA	NA	NA	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Zinc, Total	2.E-01	2.E-02	14.5	131	2.64E+00	1	1	2.64E+00	22	22	1.0	0.12	1.0	0.048	0.037	0.00067
Total PCBs	2.E-01	2.E-02	0.18	1.8	3.84E-02	1	1	3.84E-02	0.32	0.32	1.0	0.12	1.0		0.037	0
Total DDT	1.E+00	1.E-01	0.0028	0.028	3.48E-03	1	1	3.48E-03	0.029	0.029	1.0	0.12	1.0		0.037	0
Aldrin	Bench NA	Bench NA	NA	NA	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Alpha Chlordane	7.E-04	1.E-04	2.14	10.7	1.44E-03	1	1	1.44E-03	0.012	0.012	1.0	0.12	1.0		0.037	0
delta-BHC	1.E-07	4.E-08	0.56	2.25	8.14E-08	1	1	8.14E-08	0		1.0	0.12	0	2.2E-06	0.037	1.0
Dieldrin	5.E-07	Bench NA	0.077	NA	3.70E-08	1	1	3.70E-08	0		1.0	0.12	0	0.000001	0.037	1.0
Endosulfan I	9.E-09	Bench NA	10	NA	8.88E-08	1	1	8.88E-08	0		1.0	0.12	0	2.4E-06	0.037	1.0
Endosulfan II	0.E+00	Bench NA	10	NA	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Endosulfan sulfate	1.E-08	Bench NA	10	NA	1.18E-07	1	1	1.18E-07	0		1.0	0.12	0	3.2E-06	0.037	1.0
Endrin aldehyde	1.E-05	1.E-06	0.01	0.1	1.18E-07	1	1	1.18E-07	0		1.0	0.12	0	3.2E-06	0.037	1 0
Endrin ketone	1.E-05	1.E-06	0.01	0.1	9.99E-08	1	1	9 99E-08	0		1 0	0.12	0	2.7E-06	0.037	1.0
Gamma Chlordane	1.E-03	2.E-04	2.14	10.7	2 28E-03	1	1	2.28E-03	0.019	0.019	1.0	0.12	1.0		0.037	0
gamma-BHC (Lindane)	7.E-08	7.E-09	2	20	1.41E-07	1	1	1.41E-07	0		1.0	0.12	0	3.8E-06	0.037	1.0
Heptachlor	Bench NA	Bench NA	NA	NA	3.36E-04	1	1	3.36E-04	0 0028	0.0028	1.0	0 12	1.0	2.9E-06	0.037	0 00032
Heptachlor epoxide	Bench NA	Bench NA	NA	NA	3.55E-08	1	1	3.55E-08	0		1 0	0 12	0	9.6E-07	0.037	1.0
Methoxychlor	Bench NA	Bench NA	NA	NA	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
Total PAHs	0.E+00	0.E+00	40	400	0.00E+00	1	1	0.00E+00	0		1.0	0.12	0		0.037	0
bis(2-ethylhexyl)phthala	1.E-02	Bench NA	1.1	NA	1.16E-02	1	1	1.16E-02	0.097	0.097	1.0	0.12	1.0		0.037	0
Di-n-butylphthalate	3.E-02	3.E-03	0.11	1.1	3.84E-03	1	1	3.84E-03	0.032	0.032	1.0	0.12	1.0		0.037	0
Diethylphthalate	Bench NA	Bench NA	NA	NA	2.16E-03	1	1	2.16E-03	0.018	0.018	1.0	0.12	1.0		0.037	0
Dioxin - TEQ	1.E-01	1.E-02	0.000014	0.00014	1.85E-06	1	1	1.85E-06	1.5E-05	1.5E-05	1 0	0.12	1.0	4.2E-10	0.037	8.5E-06

Notes:
NA = Not available/applicable
Bench NA = Benchmark not available

Food Chain Model Components:

$$\text{Hazard Index Estimate} = \frac{\text{[Food Dose] + [Sediment Dose] + [Drinking Water Dose]}}{\text{Toxicological Benchmark}}$$